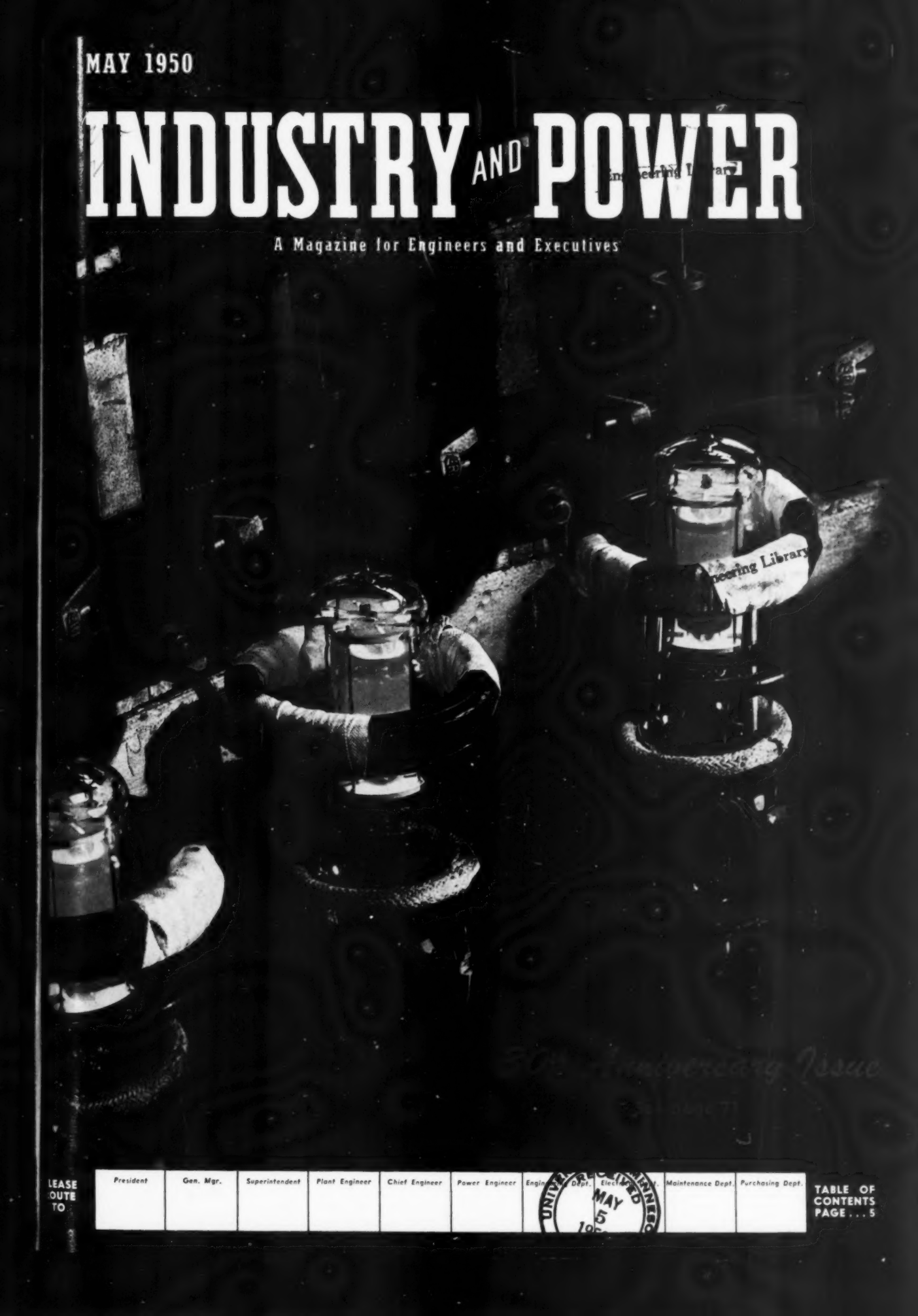
MAY 1950

INDUSTRY AND POWER

A Magazine for Engineers and Executives



Anniversary Issue

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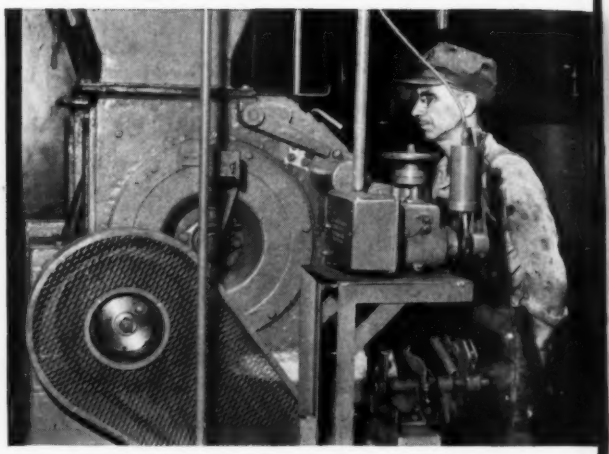
what results do you want from

Specific problems call for specific results. Here's proof that industrial plant management gets results as planned, with Hays automatic combustion control systems.

your combustion control system?

Increased efficiency? "Our basic reason for installing the Hays electric automatic combustion control was to obtain better efficiency. Our aim was more than reached . . . efficiency has climbed, attaining 79.3%." *Plant Engineer Manhattan Rubber Div., Raybestos-Manhattan, Inc.*



Rapid response to wide load swings? "We have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs. per hr. with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%." *Chief Engineer of Power Plant, Bemis Bros. Bag Company*

Low maintenance? "Our aim has always been to eliminate the need for maintenance wherever possible . . . and we are particularly pleased that maintenance has been "nil" with the (Hays) automatic combustion control system." *Chief Engineer, Kurth Malting Company*

Fuel savings? "Our fuel cost per pound of steam has dropped so much since we installed (Hays) instruments and combustion control, that fuel savings alone have been enough to pay for the investment in one year's operation." *Power Plant Chief Engineer, Vollrath Company*

Good CO_2? "The (Hays) controls in combination with our instruments make it possible to maintain high efficiency, as indicated by the 14½% average CO_2 obtained, and keep complete records of our operation." *Chief Engineer, Geo. Ziegler Company*

How to get results

Hays application engineers will provide consultation on the special problems facing your plant. Through careful analysis, working with your actual operating conditions they will recommend methods to achieve the results you want. Do you face any of these conditions?

- *Fuel savings—or special fuel problems*
- *Plans to meet increasing load demand*
- *Widely fluctuating loads*
- *Improving efficiency in your plant*
- *Problems in boiler and stoker maintenance*
- *Meeting smoke abatement ordinances*
- *Modernization of obsolete equipment*
- *Accuracy of control in processing*
- *Need for permanent records on combustion performance*
- *Other...*

Send for Bulletin No. 49-605 which describes how Hays equipment serves industry. For specific preliminary recommendations, without obligation, send us a brief statement of your combustion problem. Hays Corporation, Michigan City 2, Ind.

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MICHIGAN CITY, INDIANA, U.S.A.

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Edited particularly for the plant engineering group — those men responsible for the generation, transmission, distribution and utilization of energy in its various forms for power, processing and related plant services

INDUSTRY AND POWER

A Magazine for Engineers and Executives

VOLUME 58 — **MAY, 1950** — NUMBER 5

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Cover Illustration

Electrical power, converted to radio frequencies from the work-a-day 60-cycle current, heats the metal parts in the evacuated, glass rectifier bulbs to incandescence to remove the last traces of adsorbed gas at the Westinghouse Electric Corp. lamp works. Eddy currents are induced in the metal parts by the high frequency field of the water-cooled copper coils encircling the bulbs.

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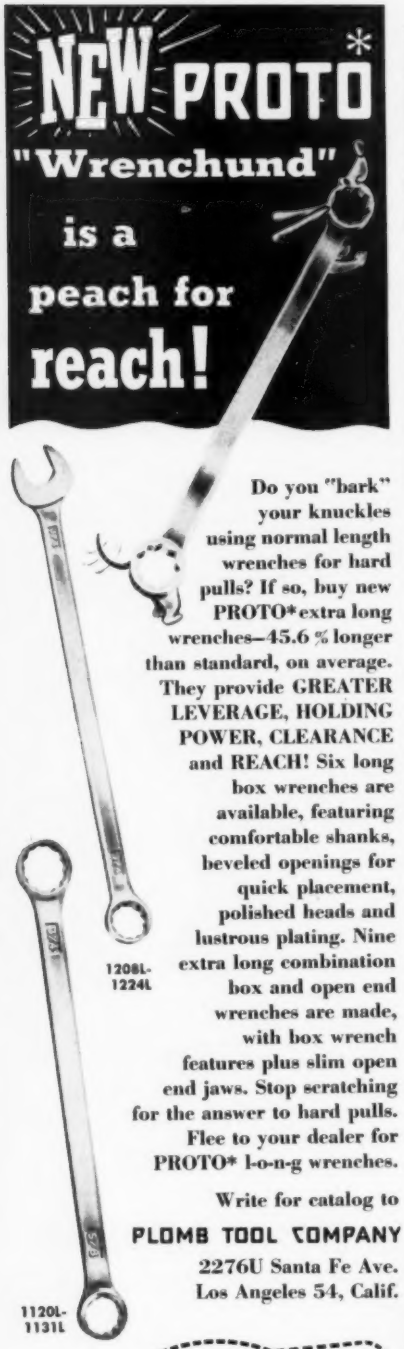

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Apropos of—

The Individual

THERE'S never an election rolls around that fails to produce its star campaigner. When he begins his electioneering, he speaks before every important group and organization, in every major city and town. He makes sure he presents his platform interpretation in the right places. But he becomes a star campaigner and is elected to office because he remembers that each of these "places" is a group of individuals. He talks to John Doe, a farmer, about what he plans to do for the farm group. He kisses Mrs. Smith's baby to show his interest in the problems of home and family. He shakes the hand of Mr. Jones to express his good faith in safe-guarding the interests and rights of all bricklayers. He knows it's the all-important *individual* who ultimately says "yes" or "no" and brands his venture with success or failure.

Our circulation policy closely parallels this picture of a successful election campaign. Instead of a campaign, however, we label our circulation work "placement" and the voting goes on every day which means a never-ending alertness to our campaigning details.

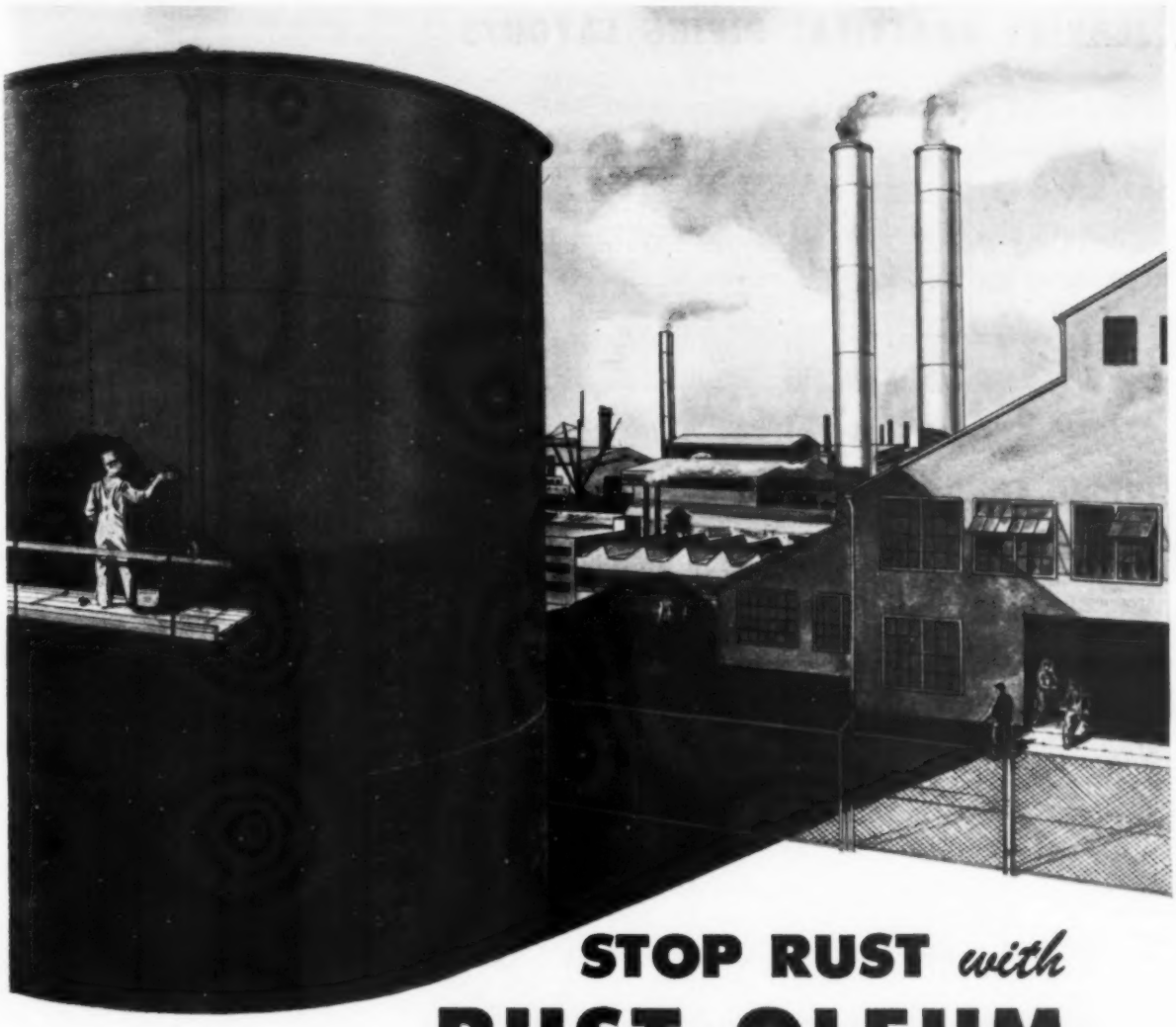
Proper *placement* first calls for careful selection of every sound and progressive plant in the United States. Then comes the checking and re-checking of this list, day after day. There can be no let-down if the newer plants are to be added to this list as soon as their eligibility has been established. An equal amount of vigilance is required to make sure the plants which have been added maintain their high rating in industry.

Secondly, proper *placement* calls for the selection of key personnel to whom the magazine can be directed. This vital element of *placement* was begun by INDUSTRY AND POWER almost a year ago. It's a big job. At our last count we had more than thirty-seven thousand organizations on our circulation list. Our job is to check each plant. Where personal names are desirable, our next move is to find one or more individuals, depending upon the size of the establishment, to whom we should address our magazine. This person must be a member of the plant engineering group and must be an active, interested reader of INDUSTRY AND POWER. He is thoroughly familiar with the importance of our magazine to the progress and improvement of his own operations and for that reason shares it with such men as the vice president in charge of engineering, superintendent, plant engineer, chief engineer, power engineer, electrical engineer, master mechanic, maintenance superintendent and purchasing agent. That's why the individual names for our placement list must be selected with such care. That's why we solicit the cooperation of our readers in helping us accomplish this task more quickly and more accurately. You can help by returning promptly the questionnaire which we mailed a few weeks ago. Just fill in the names requested and we'll review the stencils for your plant as quickly as possible. This questionnaire becomes a double-check for the thousands of names we have already added and a guide for those changes yet to be made.

Tested methods and ideas—workable solutions to problems you readily recognize in your own plant—are your reward. Thus, it pays you to screen each *individual* issue of I&P as carefully as we screen each *individual* reader.

M. J. Sanders

Exec. Vice President



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If you have a rust problem, and would like a free survey and recommendations, send your name and address on your business stationery. A qualified factory representative will arrange this free service, which includes a trial size of Rust-Oleum for specific test purposes. There is no obligation on your part. Write today.

Every day rust eats away at your metal tanks, buildings, fences, stacks . . . everything metal inside and outside your plant. Yet, rust and costly rust depreciation can be *stopped instantly . . . economically* . . . with RUST-OLEUM.

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JENKINS PRACTICAL PIPING LAYOUTS 50

CODE	QUAN.	JENKINS VALVES	SERVICE
A	1	Fig. 92 — Bronze Sw. Check	Prevent System Backflow to Water Supply
B	1	Fig. 47 — Bronze Gate	Water Supply to Closed System
C	1	Fig. 47 — Bronze Gate	System Connection to Expansion Tank
D	1	Fig. 92 — Bronze Sw. Check	Prevent Reverse Flow to Pump
E	1	Fig. 106-A — Bronze Globe	Pump Discharge Regulation
F	2	Fig. 47 — Bronze Gate	Heat Exchanger Shut off
G	1	Fig. 106-A — Bronze Gate	Flow Control to Individual Cooling Coils
H	1	Fig. 47 — Bronze Gate	Warm Water Return Shut Off
J	1	Fig. 47 — Bronze Gate	Pump Suction Shut off
K	2	Fig. 106-A — Bronze Globe	Drain Valves
L	1	Fig. 106-A — Bronze Globe	Pressure Gage Control
M	1	Fig. 106-A — Bronze Globe	Air Cushion Release
N	1	Fig. 106-A — Bronze Globe	Pump Vent

CLOSED EXPANSION TANK PIPING CONNECTIONS

To provide for changes in system water volume (due to water temperature variations), an expansion tank is used in water heating or cooling systems. The tank may be of the open, vented or (as illustrated) closed type. The latter has the advantage, in that it can be located anywhere in the system. Layout shows it tied into discharge side of circulating pump.

Supply valve is left open throughout filling operation. Water fills entire system compressing the air in expansion tank. When tank pressure equals that of supply water the supply line check valve closes automatically.

As system water cools and contracts, pressure drops below that of supply water, opening check valve until pressures equalize. Should system water temperature rise too high, a relief valve opens, draining water back into tank, compressing the air to above water supply pressure. A check valve prevents water flow back into supply line.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

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VALVE RECOMMENDATIONS
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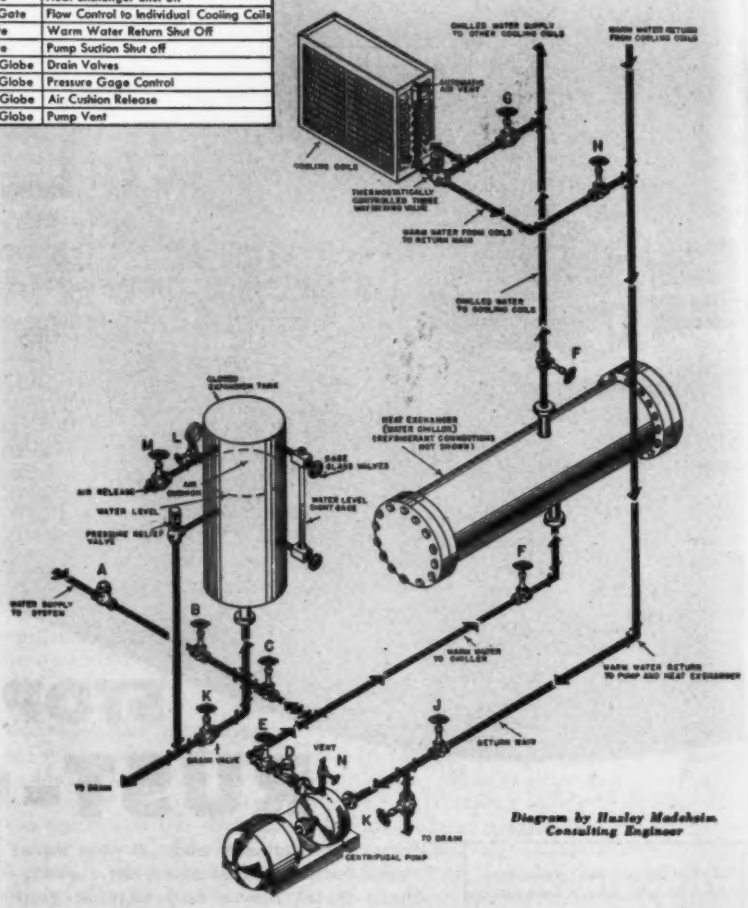

Diagram by Huxley Madeheim Consulting Engineer

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES SINCE 1864
TRADE JENKINS MARK

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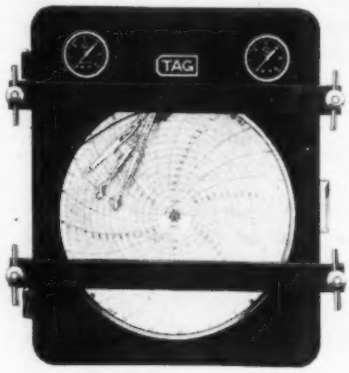
NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You Are Interested.

301—INSTRUMENT RECORDS & CONTROLS HUMIDITY

An instrument which records and automatically controls humidity has been announced by the Weston Electrical Instrument Corporation. Utilizing the psychrometric wet and dry bulb principle, the controller automatically regulates the wet-bulb (relative humidity) depression for which it is set, regardless of any fluctuations in the dry-bulb temperature.

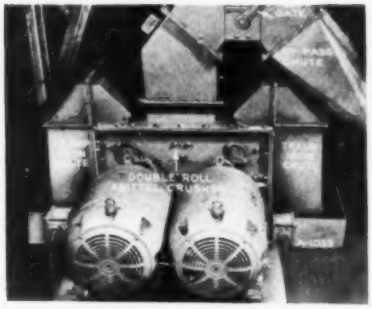
Two pens operate on a circular 10-in. chart, simultaneously recording the



dry-bulb temperature and the wet-bulb depression. The flow of the humidifying agent, moisture, steam or oil fog, is regulated by a valve which is operated by the control instrument.

302—DOUBLE ROTOR CRUSHER PREVENTS CLOGGING

Retaining all of the advantages of the standard Knittel unit, the S-A double rotor crusher has expanded the application of this type of crusher to include any materials which tend to clog and reduce crusher capacity. Power plant installations show that this unit gives the same economical hp per ton



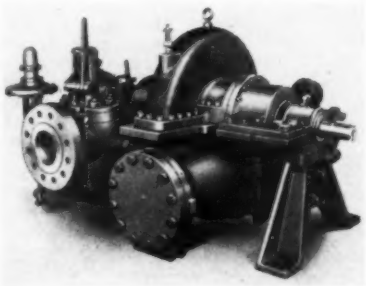
ratio with wet coal that has been achieved on dry coal by the standard crusher.

The S-A double rotor crusher is equipped with two rotors driven by separate, direct coupled motors. Synchronization is unnecessary, as the crushing sectors on the rotors operate independently, first splitting the coal on initial impact and then crushing it on the breaker plates. Sized slots in the crusher grate bars determine maximum size of material. The Stephens-Adamson Mfg. Co.

303—SINGLE-STAGE TURBINE OPERATES AT 1450 PSI

Standard single-stage turbine is designed especially for high pressure service. Initial pressure to 1450 psig, initial temperatures to 950° Ftt and back pressures to 300 psig.

To provide for extreme thermal expansion encountered in high tempera-

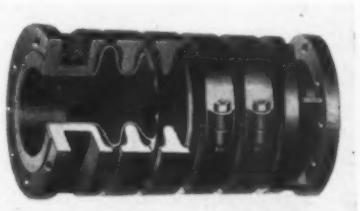


ture service, the turbine is supported at the true centerline and the front end is mounted on a flexible channel. This method of mounting permits both radial and axial expansion to take place without disturbing the shaft centerline.

The turbine can be furnished with any of eight different types of governors. A separate trip operating independently of the governing system gives positive protection against overspeeding. The De Laval CP turbine is made in three sizes for capacities to 2000 hp. De Laval Steam Turbine Co.

304—CORRUGATED JOINTS ELIMINATE MAINTENANCE

Expansion and contraction caused by temperature changes in pipelines are controlled by packless, in-line, corrugated expansion joints. Available in two types—controlled-flexing joints

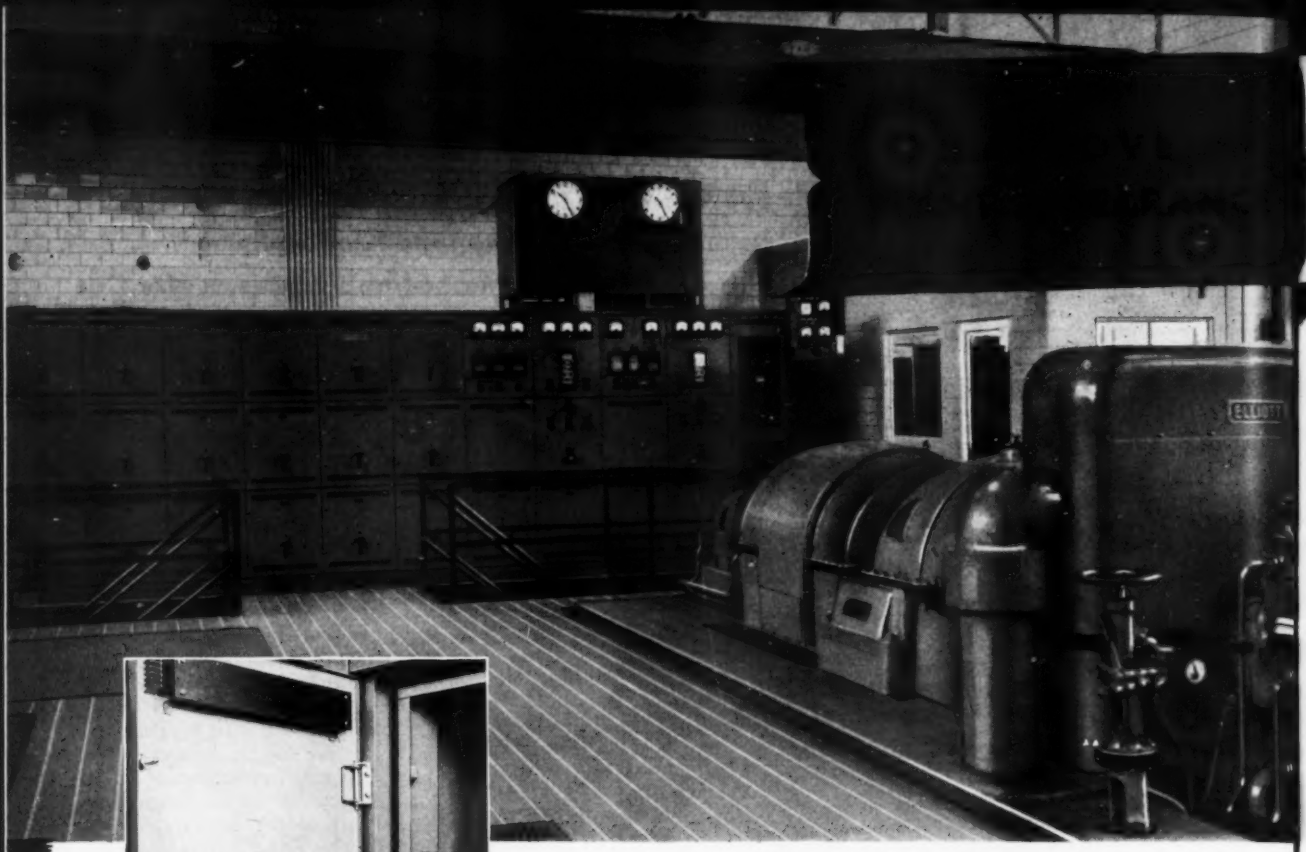


with control rings for high pressure; free-flexing joints without control rings for lower pressures.

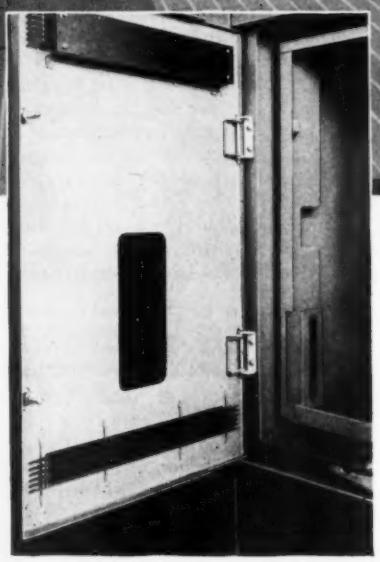
Joints of copper, stainless steel, or other alloys range in size from 3 to 24 in. ID. Units are fabricated with single or multiple corrugations with or without control rings and may be had with flanged or welding ends. Units with stainless steel inner liners, tie rods and special flanges and welding combinations are available to meet individual installation requirements.

Axial pipeline traverse of 7½ in.

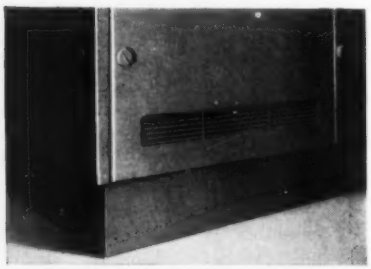
(Continued on page 12)



Photograph—Courtesy Falls City Brewing Co., Louisville, Ky.



All panels and doors are full-formed sheet steel. Corners are turned and welded for greater rigidity. All hinges are concealed by being mounted *inside* the enclosure. Effective grilled louvers contribute to the smooth, neat appearance of the switchboard.



Practical and attractive sturdy channel base can be bolted to the floor, or it can be inset either part-way or flush with the floor surface. Formed top trim and end panels complete the elimination of dangerous and unsightly raw metal edges.

MULTUMITE SWITCHGEAR IS ATTRACTIVE!

Note the compactness and beauty in the construction of the typical Multumite assembly above. With the exception of the breaker-operating handles and the semi-flush instruments, the exterior of the board presents a flat surface from top to base. All parts of the enclosure are full-formed from sheet steel—there are no raw metal edges. Grilled louvers and easy-to-adjust door hinges are hidden inside, adding to the pleasing appearance of the board.

The exterior finish of Multumite switchgear is an oven-baked synthetic enamel—bonderized to the metal to guarantee a permanently attractive surface.

GET THESE DESCRIPTIVE BULLETINS:

6003-D A complete reference guide to I-T-E 600 V Switchgear assemblies. Contains dimension information on I-T-E Multumite, and helpful facts for specifying and ordering complete switchgear installations.

7000-A Describes I-T-E's newest 5 KV Switchgear—is illustrated and supplemented with practical, easy-to-read drawings and diagrams. If you have any questions on modern HV switchgear construction, it will pay you to have this bulletin.

Get both bulletins—ask your local I-T-E Representative, or write I-T-E General Offices.

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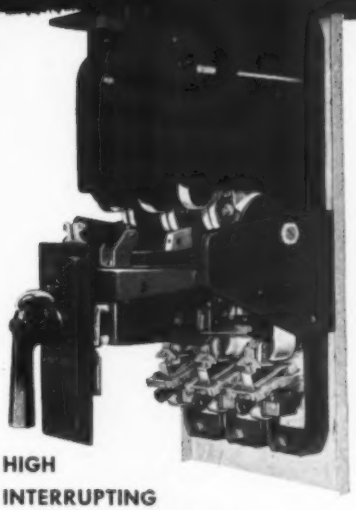
I-T-E Multumite Switchgear is specially designed o provide the *extra margin of safety* so necessary to uninterrupted service of electrical circuits. Metal-enclosed Multumite Switchgear assures positive protection of secondary distribution systems. *Here are some reasons why:*

1. Breaker's metal panel separates bus and breaker compartment, seals off ionized gases.
2. Silver-plated buses and connections eliminate progressive oxidization, minimize temperature rise.
3. Easy accessibility of breakers and bus compartments facilitates inspection and maintenance.
4. Enclosure of control wiring in metal troughs provides a new degree of safety and protection.
5. Specially designed arc chutes quench arcs *quickly* and dependably, *in air.*
6. Breakers are mechanically and electrically trip-free.

These examples of extra quality—extra protection built into I-T-E Switchgear are typical. Investigate the others.

All I-T-E Switchgear assemblies offer the benefits of an application planned for your specific needs, with units coordinated for most effective protection. Quick, easy installation is assured. *Complete* assembly is tested *before* shipment. Quality is fully guaranteed.



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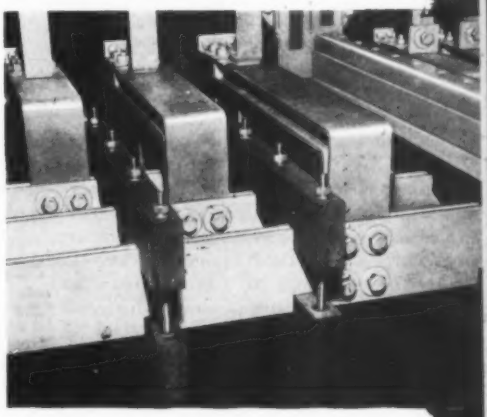

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I-T-E

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For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

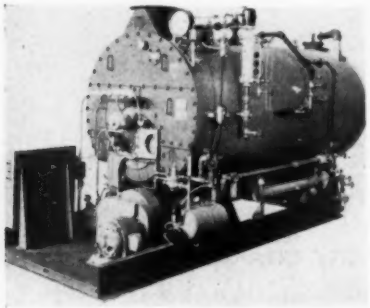
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS
RESISTORS • SPECIAL PRODUCTS

(Continued from page 9)

can be controlled with a single controlled-flexing joint—traverse of 15 in. in a single pipe run can be had with a "dual" controlled-flexing joint. Lateral motion of 1/16 in. per corrugation, or a maximum offset of 1 in. can also be handled. Joints operate under pressures to 300 psi and temperatures to 1600° F. Chicago Metal Hose Corp.

305—PACKAGED BOILER HAS ROTARY BURNER

Self-contained boiler—model LR—makes effective use of today's low-cost fuels, heavy oils and gas, accord-



ing to the maker, Cleaver- Brooks Co. The model features a rotary burner that is simple, compact and fully automatic and provides unprecedented flexibility in burning heavy oils or industrial gases. A single, low-speed, low-power consumption blower furnishes all combustion air.

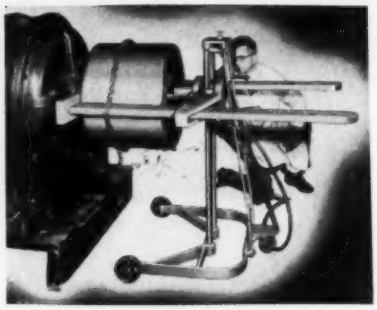
Totally enclosed, drip and dust-proof panel protects all major electrical controls. Electronic combustion safety devices and dual low-water cut-offs are standard equipment. The simplified design of a combination gas-oil burner permits rapid changeover from oil to gas or the reverse in less than a minute.

Model LR is all-welded construction, meeting standards of the ASME code of the four-pass fire tube design.

306—HYDRAULIC PULLEY PULLER RATED AT 50 TON

Portable hydraulic puller, rated at 50 ton pressure, has just been introduced by the Industrial Engineering Equipment Co. This piece of equipment supplements two other pullers, one of 5 ton and the other of 20 ton capacity.

The model is especially designed to remove large pulleys, wheels and gears from shafts, handling jobs beyond the capabilities of the smaller units. Two feet at the ends of adjustable arms are placed behind the object to be removed



and a ram is placed in position against the end of the shaft. Pressure applied by the ram against the shaft by means of a hydraulic jack quickly loosens and removes the object without damage.

The 50 ton model has a special heat treated alloy steel cross beam, puller arms and feet. Pressure exerted by the ram is regulated by a 3-speed hydraulic pump. Though more than 600 lb in weight, the puller can easily be moved and operated by one man. Pulleys as large as 42 in. in dia with face width up to 48 in. can be handled.

307—SIEVE SHAKER VIBRATES 3600 TIMES PER MINUTE

The Syntron Company have a vibrating, test sieve shaker for laboratory screen analysis work that is small in size, easily portable and quiet in operation on 110 volt a-c convenience power outlets.

The vibrating action of the shaker is produced by the Syntron patented electromagnet drive energized by rec-

tified, half-wave a-c—3600 vibrations per minute, from 60 cycle. There are no bearings, gears, belts or pulleys to maintain and replace—no lubrication required.

Amplitude of vibration is regulated by a rheostat located in the front of the base cabinet—readily accessible for quick and easy setting. A reset timer provides accurately timed test periods.

The sieve shaker is mounted on three adjustable feet that permit perfect leveling to the spirit level on the base rim. It is simple and easy to place the six 8 in. dia. sieves in the shaker.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

308—EXCHANGER FEATURES CUPROUS BUNDLE

Standardized exchangers, featuring all-cuprous, removable tube bundle

construction, is now available from Ross Heater & Mfg. Co. in a broad range of sizes which not only compare favorably in cost with many iron and steel shell units, but actually cost less in the smaller sizes.

Originally designed for service on Navy combat vessels, the type BCP has just been extensively redesigned. A smaller, less expensive unit now serves the same conditions that formerly required larger, costlier sizes. Virtually unlimited use by industry has thus been made possible, the manufacturer claims.

309—RADIATION PYROMETER FEATURES QUICK SIGHTING

Tube, built to work with this company's Micromax and Speedomax Rayotube instruments, is an important advance in radiation pyrometry. This advanced design detector is unusually easy to apply.

Quick-sighting optical system lets user select desired target easily, and then check the sharply-defined area which the tubes sees. Increased sharpness is also of benefit when radiation

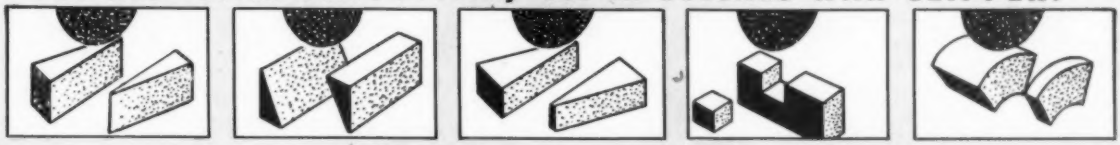
(Continued on page 14)

I NEVER WOULD HAVE BELIEVED IT - BUT I SAW IT DONE!

Yes! I SAW THE 1950 Clipper MASONRY SAW MAKE THESE CUTS in SECONDS

Make your own special shapes from standard refractory stock — easy, fast, economical. Clipper-Cut precision fits eliminate breakouts, spalling, costly down-time. Salvage obsolete materials by cutting to desired size.

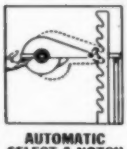
SPLITS — SKEWS — ANGLES — SOAPS — WEDGES — NOTCHES — FEATHER-EDGES — STRAIGHTS . . . Any Cut *in Seconds* with CLIPPER!



THE FREE TRIAL RIGHT IN OUR PLANT CONVINCED EVERYONE FROM THE PLANT AND MAINTENANCE SUPERINTENDENT TO THE MASONS... THAT PRECISION "TAILOR-MADE" CUTS LESSENED "DOWN TIME" -A REAL SAVING TRY A CLIPPER TODAY!

. . . DIRECT FROM THE FACTORY

PATENTED EXCLUSIVE CLIPPER FEATURES



AUTOMATIC SELECT-A-NOTCH

One man easily adjusts Cutting Head to desired height. Operators hands merely guide. All weight is supported by rear bar.

AUTOMATIC BLADE PRESSURE

Makes your blades last longer because Equalizer Spring Automatically cushions blade pressure on HARD or SOFT materials.

ADJUST-A-CUT CONTROL

Merely pull the knob — and the cutting head is free for "finger-tip" setting at any desired angle. Release knob and lock.

ONE-SPOT OPERATION

From ONE SPOT at the front of this Clipper the operator performs every cutting operation and makes all saw adjustments.

WET-OR-DRY PUMP

No need to remove belt when cutting dry. No maintenance.. Factory Sealed. An exclusive Clipper development.

SAVE-A-BLADE "NO GUESS WORK"

Automatically cushions pressure on Clipper Superior Abrasive blades. Also protects valuable Clipper Diamond blades. Match arrows. An exclusive patent.

THE ORIGINAL MASONRY SAW

Clipper

NATION-WIDE DIRECT FACTORY SERVICE

MANUFACTURING CO.

KANSAS CITY 8, MISSOURI

Cable Address: CLIPPER K. C. Mo.

PHILADELPHIA • ST. LOUIS • CLEVELAND • AUSTIN, TEX.
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DRY ABRASIVE | DIAMOND BLADE | WET ABRASIVE

CUT WET or CUT DRY

There's a Clipper Blade for Every Job!

MAIL THE COUPON NOW!

CLIPPER MANUFACTURING COMPANY 70
13 E. 28TH ST. • KANSAS CITY 8, MISSOURI

Send TODAY information on the FREE TRIAL offer and complete literature and prices on the 1950 Clipper Masonry Saws.

NAME _____

COMPANY _____

STREET _____

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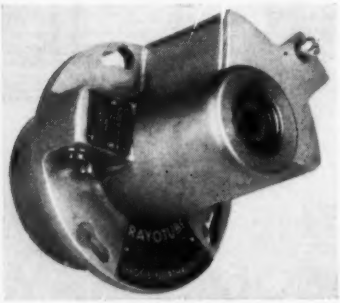
STATE _____

(Continued from page 12)

comes from end of a closed tube. Hermetically sealed construction at lens, window, and leadwires keeps out dust and gases. Design guards inherent



accuracy and stability, even with high or rapidly changing housing temperatures.

Purposely designed for easy, low cost replacement, this unit requires no protection against high ambient temperature unless its housing temperature exceeds the very high figure of 350° F. Below that point, any previously installed water- or air-cooling can simply be turned off or disconnected. Leeds & Northrup Co.

310—STRAIN INDICATOR HAS HIGH ACCURACY

Type "L" portable, battery-powered strain indicator for bonded resistance wire strain gages is announced by the Baldwin Locomotive Works. Four major improvements have been made in this direct reading instrument. First, the ten "Thousands" steps are increased from 1000 to 2000 microin. per in. per step. Second, the range extender has been increased from an approximate 10,000 microin. to a more exact 20,000 microin. with an accuracy within plus or minus 50 microin.

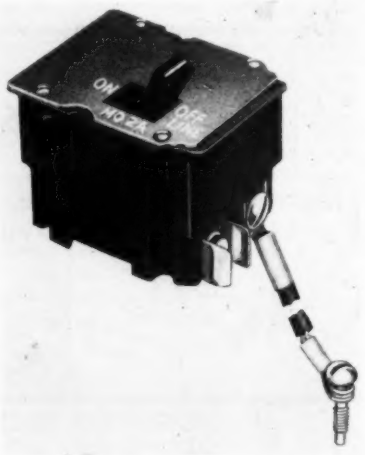
Third, the new model can be used with a completely external Wheatstone bridge circuit without modifying the internal circuit. Fourth, provision is made for an oscilloscope connector jack.

The instrument is designed and calibrated for 120-ohm gages with gage factors of 1.77 to 2.20. An a-c/d-c converter is available for operating the indicator on 110-volt, 60-cycle, single-phase electric power when required for continual operation. The instrument measures 6x9x12 in. and it weighs about 25 lb with batteries.

311—CIRCUITS EXTENDED WITH MULTI-BREAKER

Square D Company announces a new 2-pole "Ad-On" multi-breaker to extend circuit arrangements on Type MO 8 "Ad-On" load centers.

The Type MO 8 load center can now be extended to include up to a



maximum of three double poles in combination with various single pole "Ad-On" circuits for lighting loads.

The new Type MO 2A "Ad-On" is a thermal-magnetic, common trip breaker having only one operating handle. It offers a quick, convenient way of controlling many 220-v loads.

312—MAGNETIC SWEEPER HAS PERMANENT MAGNET

A magnetic sweeper that is run along shop floors to pick up stray nuts, bolts, screws and small metal parts has been introduced by Ullman Products Corp.

The sweeper is 12 in. of powerfully magnetized sweeping surface. It rolls easily over floors on fibre wheels, picking up all small metal parts. Compactly designed to get into narrow spots, it reaches into corners, under benches and machines. A special patented fea-

ture enables releasing the sweepings by merely opening the cover. This breaks the magnetic adhesion and articles drop off instantly. The magnet is permanent.

313—FLUORESCENT LIGHT FOR OUTDOOR SERVICE

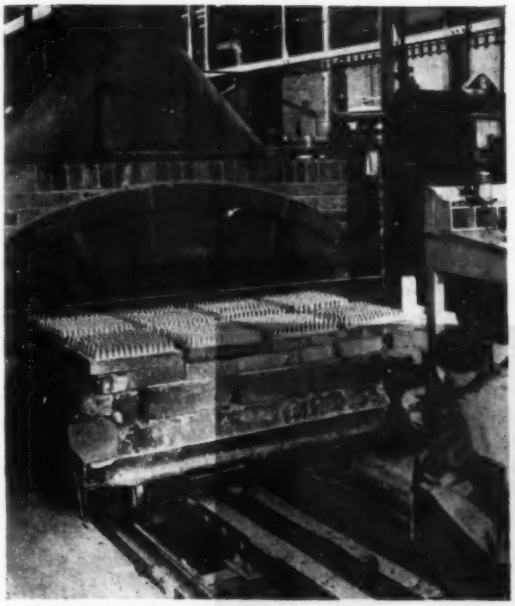
A fixture designed for outdoor installation on building walls is now being offered by Guardian Light Company. This wall light is listed by Underwriters' Laboratories, Inc. Completely assembled and wired, including four 40-watt T-12 fluorescent lamps, the fixture has a ventilated chamber to insure long life of the instant-start high power factor ballasts it houses.

Outstanding features include the enamel-finished steel chasis and extruded aluminum hinged frame. A double action arrangement permits the frame to be opened either to the left or right as location of installation dictates. The weatherproof frame is caulked and sealed with sponge rubber. Overall height of unit is 54½ in.

314—FLUID PRESSURE BOOSTERS SAVE SPACE

Low cost, efficient, production-line fluid pressure boosters that save space, weight and develop working hydraulic output pressures up to 10,000 psi from ordinary plant air or hydraulic input pressures are now being offered in a complete line of convenient sizes, pressure ratios and mounting styles by

(Continued on page 16)



How to Use "dag" Colloidal Graphite for 141 industrial purposes

READ the NEW Acheson Bulletin #424 on the subject **"dag"** colloidal graphite for industrial lubrication.

"dag" colloidal graphite is unique in its *combination* of uses and properties. It is **slipperier than oil . . . perfect for assembly** and run-in, and for high temperature applications. **It clings and endures** . . . the ideal rugged lubricant. It lubricates oven **car wheels and hot conveyors. It is** chemically inert . . . supplies solvent-resisting dry films for **degreaser conveyors** and alkali washers, reduces corrosion and galling.

But these suggestions merely hint at the wide scope of **"dag"** colloidal graphite. Dry films of graphite produced from solvent and solvent-binder dispersions are especially useful. **"dag"** colloidal graphite can be incorporated into your present lubricants. Get your own ideas . . . see the current list of uses and get the NEW Bulletin #424 on **"dag"** colloidal graphite for Industry. If you like, ask to see an Acheson engineer, experienced in finding new and cost-saving ways to use **"dag"** colloidal graphite.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Bulletin #424
☐ Send me the "List of Industrial Uses"
☐ Send an Acheson engineer

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STREET.....

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E-17

dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan
. . . also Acheson Colloids Limited, London, England

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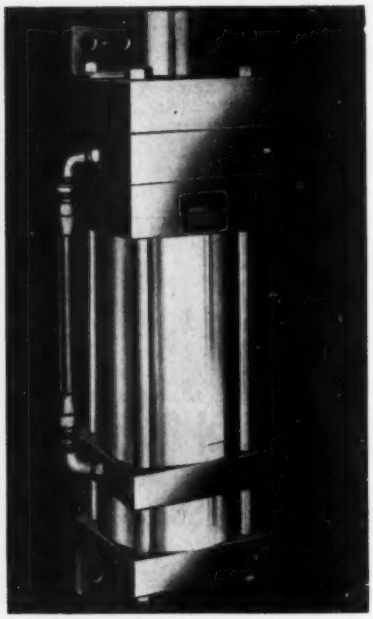


Miller Motor Company.

These boosters hold pressure indefinitely without motion or heat generation, they can often be employed for greater economy and efficiency in place of hydraulic pumps, which must continue to pump, develop heat and by-pass oil as long as pressure is held.

In booster operation, input pressure may be either air or hydraulic; output is always hydraulic. Operating speeds range from 30 to 450 strokes per minute. Availability of these boosters in a wide range of pressure ratios permits selection of most any desired size and power output.

315—VINYL RESIN FOR WATER-SUBMERGED SERVICE

A vinyl resin formulation for pretreatment of metal scheduled for water-submerged service is announced by The Dampney Company of America, manufacturer of specialty protective coatings. The material, identified as Dampney Metal Primer, serves two functions, acting both to inhibit corrosion temporarily prior to finish coating and to prepare the surface of the material for finishing.

Marine-tested in what is considered the most severe type of water-immersion service, application to ships hulls, this vinyl formulation meets the most stringent requirements. It is also recommended, in combination with Apexior No. 3, for service in water-storage tanks, condensers, locomotive tender cisterns and wherever metal is exposed to fresh or salt water at temperatures to 140° F.

Application is with either brush or spray to any type of clean metal. Only one coat is required. Recommended coverage is less than tissue-paper thickness, one gallon protects 800 to 1000 sq ft of surface. The applied film dries rapidly so that no more than ½ hr need elapse before finish coating.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

316—PLASTIC PIPE QUICKLY INSTALLED

Semi-rigid plastic pipe designated "Carlon T" features much higher tensile and flexural strengths. Extremely light in weight, long sections can be laid more rapidly and economically than comparable lengths of ordinary pipe. In one field test, for example, two men working under normal conditions laid more than ¼ mile of 1¼ in. "Carlon T" in less than 20 min.

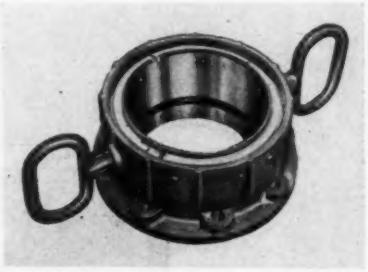
Guaranteed against rot, rust, and electrolytic corrosion the pipe is not damaged by freezing water and can be installed above or below frost level. Furnished in random 20 ft lengths,

the pipe sections are connected by means of plastic sleeves, which are first treated with a special cement and then slipped over the ends of the sections to be joined. Threaded plastic sleeves can be furnished to permit connecting to established metal pipe installations equipped with standard fittings. Carter Products Corp.

317—COUPLING DISENGAGES IN ONLY 40° TURN

Quick disconnect coupling in a 6 in. pipe size for heavy duty applications has been developed by Roylyn, Inc. Known as the 1700 series, the coupling is designed to meet the requirements of large coupling that is fast connecting and fast feeding, is light in weight with compact proportions, and is easily operated without tools. Compactness and portability are assured with a dimension between flanges of only 7 in. and a weight of only 17½ lb. The coupling is rated at 150 psi.

A 40° turn is all that is required to make or break the coupling. Locking is effected with ⅜ in. stainless steel



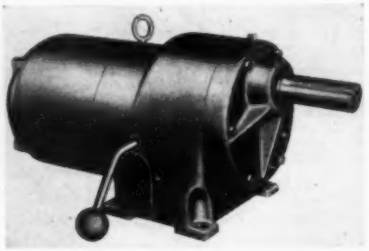
balls. Mating parts are tapered for "no-jam" connection. Sealing surfaces are well protected and not easily damaged. The seal ring, which is adequately retained and protected against loss or damage is replaceable. Working parts of the coupling are completely sealed to prevent entrance of dirt or other foreign matter.

318—GEAR SHIFT DRIVE FEATURES FOUR SPEEDS

The Lima Electric Motor Company announces the addition of a new unit to their line of gearshift drives designated as the Type R3C. Features are a combination integrally mounted electric motor and a four-speed transmission having both primary and secondary gear reductions. This unit fills the need for a compact drive of modern design providing low, multiple output speeds.

Type R3C Lima gearshift drives deliver full rated horsepower in each of the four speeds. Both constant-torque and constant-horsepower two-speed motors are available on these units, which gives the increased flexibility of additional speeds.

The drives are designed for opera-



tion on polyphase, a-c power supplies of standard frequencies (25-50-60 cycles) and voltages below 600. All Type R3C units have primary selective gear ratios of 4.15, 3.15, 1.85 and 1 to 1.

(Continued on page 124)

ONE MAN and a COFFING HOIST

DO THE WORK OF A GANG

ALL-PURPOSE HOIST

For the All-Purpose Hoist, Diamond Roller Chains provide the same reliability.

• Some wise Greek of ancient times said that if he had leverage enough he could lift the earth.

One man and a Coffing Ratchet Lever Hoist prove the old timer was right because with the multiplied leverage he can do just about anything with it—skid heavy objects—lift pipe, machines, and other materials,—bend or straighten beams,—tighten telephone or guy wires, etc.

From the early development to the present time, DIAMOND Chain engineers cooperated with Coffing engineers to provide roller chain of uniform great strength, ruggedness and dependability so essential to successful hoist performance. DIAMOND CHAIN COMPANY, Inc., Dept. 412, 402 Kentucky Avenue, Indianapolis 7, Indiana. *Offices and Distributors in All Principal Cities.*

DIAMOND **ROLLER CHAINS**

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Condensers (A) Illustrated 30-page catalog covers information on a line of condensers adaptable for large power plants. Construction details are shown and explained. Condenser tube data and pressure - temperature conversion tables are included. Condenser Service & Engineering Co., Inc.

Oil Heaters (B) Bulletin contains specifications and descriptions of medium sized oil heaters in capacity ranges between 120 to 1800 gph. The oil temperature—heated by steam—is raised to 80-100° F above the entering condition. Features of the compact unit are clearly stated. Leyman Mfg. Corp., McGowan Pump Div.

Technical Data (C) Technical data on electric resistance welded steel boiler tubes has been made available. For convenience in ordering, tables are furnished on maximum allowable working pressures for different diameters and gages of tubes for water and fire tube boilers. Another table determines the weight in lb per lineal ft of steel tubes in various minimum wall sizes. Babcock & Wilcox Tube Co.

Instruction Chart (D) Four - page folder contains a two page spread chart to show plant engineers how to determine the proper size of continuous blowdown for an installation. The remaining two pages cover instructions on how to use the chart and select equipment. Henszey Co.

Steam Jet Deaerator (E) Informative eight-page folder covers all pertinent details on construction and specifications of a steam jet deaerator. Cut away views illustrate the principles of operation clearly. A typical performance chart shows the amount of oxygen dissolved at various loads. Worthington Pump & Machinery Corp.

Fluid Coolers (F) Technical data on water, oil and liquid coolers selection is covered in a well prepared bulletin. Design formulae are simplified so after substituting table and chart values only slide rule computations are necessary. Tables and charts are included to make possible any type of selection. Of particular interest is the cross sectional drawings and explanation of floating heads and tube bundles. Condenser Service & Engineering Co., Inc.

Vertical Boiler (G) Two-page folder contains information on a new vertical boiler for high pressure steam from 3 to 15 hp capacity. Specifications and outline dimensions are shown for five boiler sizes. York-Shipley, Inc.

Boiler Caps (H) New 4-page bulletin entitled "New Life for Old Boilers" describes how old boilers can be rejuvenated at low cost, with necessary tube replacements, repairs, and hand hole caps. Several actual installations are illustrated. Key Company.

Condenser Tubes (I) Illustrated bulletin discusses the economical choice of appropriate tubing for specific service conditions in heat transfer units and for easy fabrication in heat exchanger apparatus. Methods are offered to help solve numerous field problems. Specifications and data are offered in a table on carbon, low chromium, intermediate chromium, nickle and stainless steels. The Babcock & Wilcox Tube Company.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Air Compressors (J) Colorful 18-page bulletin contains numerous photographs of featured items of this company's two stage air compressor. Cross sectional views are in color for air flow and the lubrication system specifications and dimensions are covered for three sizes: 7 in. stroke, 125 to 150 hp; 8½ in. stroke, 200 to 250 hp; and 10 in. stroke 300 to 350 hp. Discharge pressure ranges between 80 to 125 psi. Ingersoll-Rand Co.

Portable Air Compressor (K) Folder covers all features of a compact portable air compressor. Cross sectional drawings are captioned, with colored arrows leading to important parts of the compressor. Specifications are listed for the compressor and engine. Accessories and their application are included. Worthington Pump & Machinery Corp.

Diesel Engines (L) Illustrated 16-page booklet contains first hand, complete information on 4 diesel engines —models D397, D386, D375, and the D364. The booklet covers the outstanding advantages and qualities and is complete with specification and performance charts. Caterpillar Tractor Co.

Diesel Generator (M) Factual 12-page bulletin describes a powerful, single acting, two-cycle diesel engine that has a 29 in. bore and 40 in. stroke. Sizes range from 5 to 12 cylinders with ratings from 3570 to 8500 hp. General information includes: engine design, low-cost fuel requirements, scavenging system, lubrication and piston cooling system, and reversing gear arrangement. Nordberg Manufacturing Co.

WATER AND LIQUID TREATMENT

Hot Process Softener (N) Comprehensive illustrated bulletin on the most recent developments in hot - process water softeners contains introductory section that concisely explains boiler plant troubles caused by various impurities in water. Twelve different methods are outlined for treating water to eliminate impurities. Two basic designs and the operation are fully described together with six adaptations of each design to various plant conditions. Graver Water Conditioning Co., Div. of Graver Tank & Mfg. Co., Inc.

Water Cooling (O) Specification and engineering data for a compact water cooling tower are covered in colorful bulletin. Construction details are clearly explained. Dimensions and rating tables are included for each of the 8 sizes available. The Marley Co., Inc.

Chlorine Reference (D) Attractively printed two-color 44 page bulletin is a quick reference technical manual that gives basic help on containers for chlorine shipment, proper service tools, equipment, and accessories. The second section is devoted to a review of chlorine properties such as: enthalpy, vapor pressure, density, specific volume—in all there are eight tables and charts. Diamond Alkali Company.

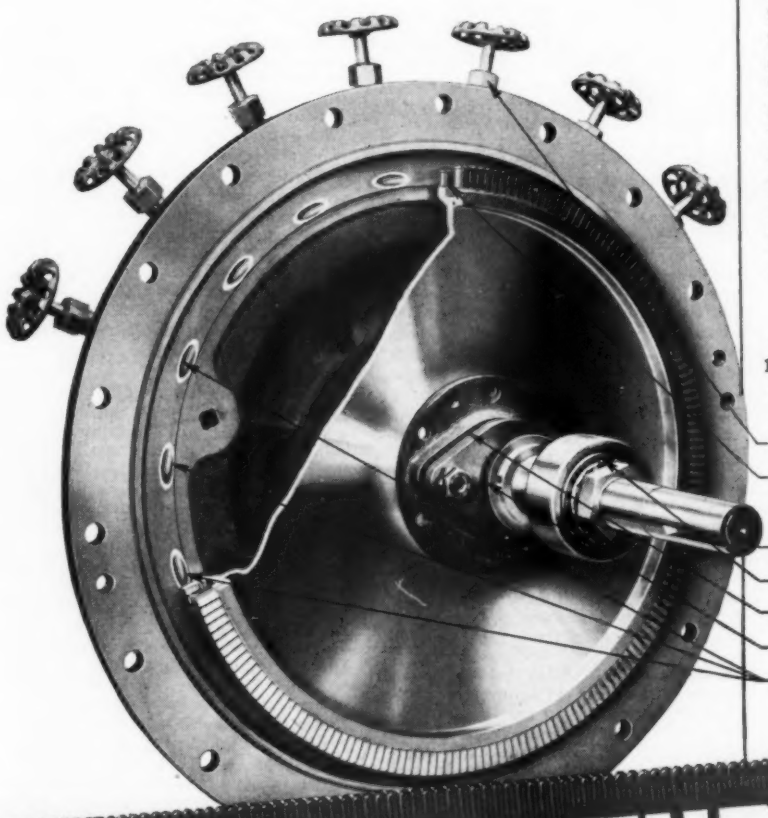
Boiler Water (Q) New 24 page booklet, in color, on water treatment and equipment covers the principles and fundamentals of providing trouble-free water in boiler plant operation, for the prevention of scale, pitting and general corrosion, for producing pure, dry

(Continued on page 20)

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



7 hand valves for efficient partial load operation, (20" turbine shown)

2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced

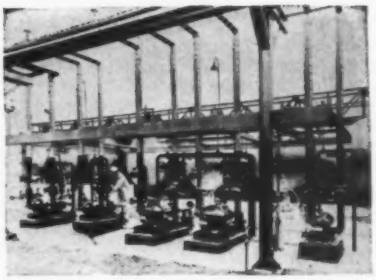
30-40 carbon steel shaft

Oversized double row deep grooved ball bearing

Stuffing box with metallic packing ring

Heavy chrome plating of shaft through stuffing box

3 nozzles always open



Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORP., 185 Park Avenue, Worcester 2, Mass.

Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

(Continued from page 18)

steam, and to avoid caustic embrittlement. A feature of the booklet is a two page diagram showing the number of tests, what tests to make, and where to make them in a water and steam cycle-power plant layout. Dearborn Chemical Company.

Chlorine Control (R) Revised handbook edition of Modern pH and Chlorine Control describes the factors to control pH chlorine and phosphates in boiler waters. The new booklet contains photographs and general instructions for the application of equipment in determining concentration tests. W. A. Taylor and Company.

ELECTRICAL EQUIPMENT

Voltage Regulators (S) Design and construction features of a transformer type ⅝% step feeder voltage regulator are detailed in a 16-page bulletin. Standard rating table for 2500, 4330, 5000, 7500, 12,000 and 13,800 volt units incorporated. Allis-Chalmers Mfg. Co.

Motor Selection (T) How to select large motors for pumping service in the oil industry is featured in a two color, 24-page bulletin. Photographs and text material also covers such subjects as: insulation requirements, safety of motor controls and electric power generation in oil fields, process plants and compressor stations. Electric Machinery Mfg. Co.

Distribution Transformer (U) Distribution transformer, completely self-protected to insure fewer outages and lower operating expenses, is described in a new 8-page bulletin. Mechanical data and the five type designations of the transformer are given, along with a typical load-time curve for one of the units. The transformers are available in ratings of 3 kva through 100 kva—2,400 to 14,400 volts. Allis-Chalmers Mfg. Co.

Synchronous Motors (V) Eight-page, two-color bulletin on low-speed synchronous motors—designated as publication GEA-5332—illustrates typical installations of high-power-factor, constant-speed drives. Construction features are explained, and mechanical modifications and performance data are indicated. Type TS (3 phase) and Type QS (2 phase) motors in the "6000 series" and ratings from 20 to 15,000 hp are covered. General Electric Co.

Oil Circuit Breakers (W) Moderate capacity oil circuit breakers of quick-clearing, non-oil-throwing design for outdoor distribution service where reliable and safe operation is required without frequent adjustment or inspection are described in a four-page bulletin. Specifications and outline dimensions are shown for three sizes that range from 23.0 kv to 250,000 kva interrupting capacity. Allis-Chalmers Mfg. Co.

Chemical Motors (X) Four-page booklet describes chemical motor operating in atmospheres where corrosive fumes and liquids are encountered. Internal construction features plus the treatment of external parts for maximum corrosion existance are described. Also included are the results of salt-spray corrosion tests, and tests comparing the relative corrosion of shot-blasted cast iron and machined steel. Westinghouse Electric Corp.

Circuit Breakers (Y) General distribution eight page, illustrated folder covers the development, production, and advantages of a non-thermal, fully automatic magnetic panelboard circuit breaker. Graphs, schematic diagrams, engineering drawings, cut away views, ratings, and data on application, operation, and construction are included. Heinmann Electric Company.

Voltage Regulator (Z) A pole-type regulator designed to correct rural low voltage conditions and improve service is described in a new 12 page bulletin. Important features of the regulator that result in trouble-free performance are shown, and the reasons why it is simple to mount, operate, and maintain are given. Allis-Chalmers Mfg. Co.

Rectifier Welders (AA) Booklet describes 200, 300, and 400 amp 60% duty cycle, selenium rectifier d-c welders. Included is engineering information on relative power costs, performance characteristics, construction details, electrical characteristics, welding characteristis, dimensions, and weights. Graphs of kva input, efficiency, and power factor at welding currents up to full load are also shown. Westinghouse Electric Corporation.

Light Dimmers (BB) File size 12 page bulletin opens with a discussion on the creation of "atmosphere" through the dimming, brightening, and blending of light. Suggested uses are illustrated, and advantages are clearly and understandably stated. Sketches illustrate several of the outstanding features of the equipment. A chart gives standard dimming electrical ratings, approximate dimensions, and weights. The Superior Electric Company.

INSTRUMENTS, CONTROLS, RECORDERS

Program Controls (CC) Bulletin describes automatic time-temperature program controllers used in the industrial processing of metals, chemicals, ceramics. Predetermined heating and cooling cycle to insure product uniformity and minimize rejects are explained. A schematic drawing of a typical time-temperature program, a listing of models, time cycle ranges and prices are included. Wheelco Instruments Co.

Selector Switch (DD) An 8-page engineering data folder complete with target sheet will be an aid to electrical engineers in understanding and applying push-pull-selector switch. The folder features detailed illustrations, descriptions and typical applications. The target sheet will assist in plotting electrical control requirements. The Arrow-Hart & Hegeman Electric Co.

Flow Meters (EE) Factual 12-page bulletin covers numerous installation hook-ups to illustrate the versatility of an area type flow meter. Advantages are listed along with construction specifications. Capacity and recommended pipe fitting sizes are included along with drawings of typical symbols for drawings. Fischer & Porter Co.

Control Panels (FF) An 8 page booklet explains how control panels are made and where they are used. All the operations of fabrication are discussed and illustrated such as electric clocks, pressure gages, transformers, name plates, push-button stations, and signal lights. The Hays Corporation.

Draft Gages (GG) Straight line bell and dial bell gages are presented in a factual 12 page bulletin. Each of the principal parts is reviewed and illustrated in a specification style. Outline dimensions are listed for all gages discussed. Ellison Draft Gage Co., Inc.

MATERIAL HANDLING

Vibrating Feeders (HH) Liberally illustrated 16-page bulletin shows this company's line of vibrating feeders and flow equipment. Descriptions accompany each photograph or drawing so a clear picture of the operation and features are obtained. Syntron Co.

Job Study (II) Outlined in detail are handling methods which resulted in savings and full utilization of formerly idle space by means of fork lift trucks. Photographs illustrate the efficient handling from freight car to storage to delivery which enabled a reduction in handling time. The study points out operating costs were reduced by $635.00 per week in addition to eliminating much tiresome manual labor and releasing six men for more important warehouse jobs. Towmotor Corp.

Conveyor Units (JJ) Colorful bulletin, containing 24 pages, gives detailed information on standardized conveyor units. Specifications on various types of elevating roller, belt, and wheel conveyors, lowering and horizontally conveying sacks, cartons, boxes, and bundles are included along with photographs. Standard Conveyor Co.

POWER TRANSMISSION

Torque Couplings (KK) Two bulletins just released cover information on a line of thrust and floating shaft couplings. One bulletin contains general descriptive material while the other gives pertinent details on method of selection, dimensions and engineering data. The Falk Corp.

Roller Chains (LL) Attractive 16-page catalog covers a complete line of finished steel roller chains manufactured by this company. Specifications and engineering data is included for single, double, triple and quadruple widths. Also illustrated and described are silent chains and sprockets. The Union Chain and Mfg. Co.

Gear Motors (MM) A new bulletin has been issued that describes the major features and illustrates various types of standard fractional and integral gear-motors. Specifications are listed for 30 complete units ranging from 1/20 to 7.5 hp. Janette Manufacturing Company.

Speed Reducers (NN) Informative 16 page brochure presents a complete story of a new torque arm speed reducer line. Full size photographs of mechanism aid greatly in understanding the underlying principles. Detailed instruction explains how to select a reducer from the tables when the speed of the driven shaft and horsepower are

known. Dodge Manufacturing Corporation.

PUMPS AND ACCESSORIES

Sludge Pumps (OO) Pamphlet explains how this pump has been engineered to handle sludge problems. A cut-away of the pump is shown, and captions—with leader lines to the important parts of the unit—give a clear picture of the operating principles and features. Marlow Pumps.

Self-Priming Pumps (PP) Catalog on self-priming centrifugal pumps covers specifications, operating characteristics, and engineering data for proper selection. Numerous photographs and illustrations are shown of basic principles and features. Marlow Pumps.

Centrifugal Self-Primers (QQ) Brochure of eight pamphlets covers detailed information on a line of self-priming centrifugal pumps, that are portable and are mounted on chassis. Features and specifications are listed for each pump and companion engine. Leyman Mfg. Corp. McGowan Pump div.

Centrifugal Pumps (RR) Three folders are offered that contain information on: long coupled, close coupled, and straight centrifugal pumps. Dimensions and engineering data are included for all sizes in each type of pump. The proper selection can be made for any situation. Marlow Pumps.

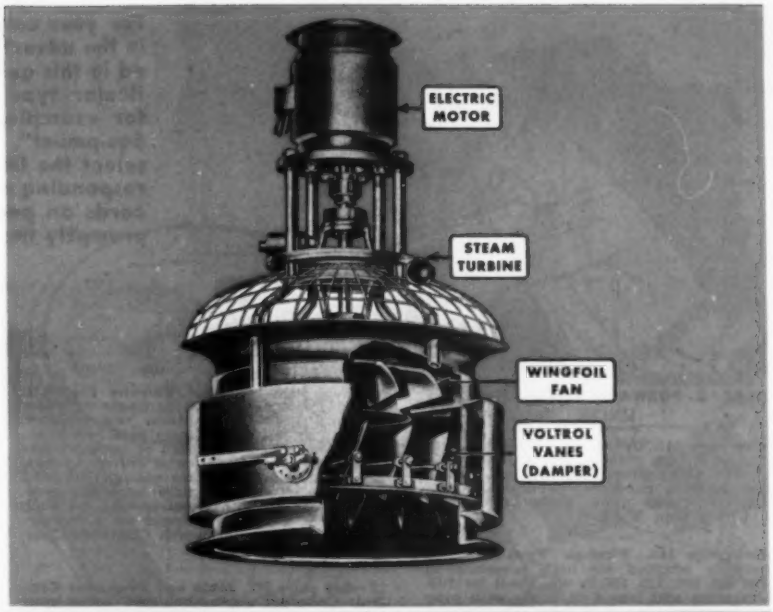
Multistage Pump (SS) 12 important operating features are explained and illustrated in a six page folder. A two page colored cross-sectional detail view of the pump is captioned and direction lines connect each feature. Overall dimensions and specifications are listed for four pump sizes. American-Marsh Pumps, Inc.

TOOLS AND SPECIALTIES

Shear Knife Handbook (TT) Pocket sized 48-page glossary contains useful information for those who specify, use, buy or grind metal-cutting shear knives. Recommendations are given for selecting the correct grade knife for the cutting to be done, and tips are presented to facilitate inquiries and the handling of orders. Several pages are devoted to standard tolerances in shear knife manufacture; to careful practices in shear knife grinding, and to the general care of shear knives. The booklet is completed by the inclusion of charts to calculate coil weight, tables for converting millimeters into inches, hardness conversion tables, and decimal equivalents. Heppenstall Co

Pipe and Bolt Machines (UU) Colorful, four-page folder contains scores of users from all over the world that relate their experiences with this company's deluxe power driven tool. Information will be of vital interest to everyone concerned with cutting, reaming and threading operations on either pipe, bolt or conduit. The material is factual and has been written by the men who use the tools. Beaver Pipe Tools, Inc.

(Continued on page 132)



New Wing Forced Draft Blower Incorporates both turbine and electric drive in one unit

With the new Wing Dual Drive Forced Draft Blower you can alternate between turbine and electric drive. Your choice of drive may be governed by consideration of heat balance, of economical operating cost, or by an emergency affecting the source of power. All you have to do is throw a switch to operate the motor or turn a couple of valves to change to turbine drive! There is no harm to either motor or turbine when one or the other is idle. A wide range of control is possible in both motor or turbine drive. Throttling gives adequate control with turbine drive and the Wing Voltrol Vanes (capacity regulating dampers) permit capacity regulation when constant speed motor is driving. Automatic operation may be arranged with combustion-control system. The unit is extremely compact and may be adapted to either vertical or horizontal discharge. Installation is simple, easy and economical. It is shipped completely assembled and aligned, ready to bolt to the foundation.

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L. J. Wing Mfg. Co.

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Canadian Factory: Montreal, Canada

Wing

DUAL-DRIVE BLOWERS

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 115. Union "S" Steam Generator: Completely steel clad, insulated setting and streamlined appearance. Large water holding capacity. Economical. Requires little floor space. Write for Booklet 119. Union Iron Works.

2—See page 154. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

3—See page 56. Factory-Completed Steam Generator: Bulletin 1000 gives all the facts on the Preferred Unit Steam Generator. Write for your copy today. Preferred Utilities Mfg. Corp.

4—See page 39. Packaged Steam Generators: New fully illustrated catalog 202 that gives complete details and engineering data for units available in 17 sizes from 20 to 500 bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

5—See page 161. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Get complete information by sending for the latest Powermaster Catalog. Orr & Sembower, Inc.

6—See page 119. Waste-Heat Boilers: Write for all the facts about how these boilers can turn ordinarily wasted heat into profitable power for you. They're designed specifically to give you maximum heat recovery from all types of waste gases. Send for literature today. The Wickes Boiler Co.

BOILER FEED WATER

7—See page 33. Cuno Flo-Klean Filter: Makes raw water suitable for many plant services, keeps recirculated water clean, pays for itself in as short a time as a year. See page 33 for coupon which offers complete information without obligation on Cuno Flo-Klean for your particular application. Cuno Engineering Corporation.

8—See page 153. Water Conditioning Chemicals: Easy to control scale and corrosion in boilers, steam and condensate lines, water jackets, condensers. Send for bulletin giving full information on Wright Chemicals and their application. Wright Chemical Corp.

9—See page 144. Oxygen Corrosion Eliminator: Santosite, maintained in boiler feed water, removes dissolved oxygen and prevents oxygen corrosion. Send for Santosite Bulletin No. 0-26. Organic Chemicals Div. Monsanto Chemical Co.

10—See page 45. Water Conditioning System: Write for full facts concerning this system that gives you, in less space, all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Send for Bulletin W-212-B2. Worthington Pump and Machinery Corp.

11—See page 165. New Versene Test Kit: Enables you to test the hardness of water in your plant in less than two minutes. As easy as telling red from blue and is accurate to within one grain of hardness per gallon. Packaged in special sturdy pocket-size plastic box. Includes enough chemical to make more than fifty separate tests. Refills available, full directions in each kit. Price is $3.00, postpaid on a money-back basis. The Bersworth Chemical Company.

12—See page 167. Scale and Corrosion Control: Colloidal action lets you solve your boiler scale problem. New scale cannot form in presence of this concentrate and old scale dissolves. Send for complete data. American Sand-Banum Co., Inc.

13—See page 172. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

CLEANERS AND BLOWERS

14—See page 171. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

15—See page 151. Vacuum Cleaning Equipment: Portable cleaners or stationary cleaning systems provide an economical solution to the problem of removing troublesome dust accumulations in industrial plants. Write now for bulletin and free survey. U. S. Hoffman Machinery Corp.

16—See page 21. Forced Draft Blowers: New dual drive lets you alternate between turbine and electric drive on these forced draft blowers. A throw of the switch operates electric motor—a turn of valves changes to turbine—quickly, easily. Compact unit adapts to either vertical or horizontal discharge. Simple, economical installation. Write for full details. L. J. Wing Mfg. Co.

COMPRESSORS

17—See page 129. Motor Driven Compressors: Write for Bulletin 4910 which contains full details and operating data on Schramm's complete line of motor driven compressors. You're sure to find the right combination for your job. Schramm, Inc.

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18—See page 31. Compressors: Class T-S designed specifically for small capacities—where steam is available at low cost or exhaust can be used. Automatic governor varies speed, reduces wear, cuts costs. Capacities range from 89 to 1990 c.f.m., with pressures from 10 to 5,000 lbs. Write for descriptive literature. Chicago Pneumatic Tool Co.

DIESEL POWER

19—See page 125. Smaller, Lighter, Heavy-Duty Diesel Engine: Ingersoll-Rand TS Diesel available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. Extra stamina and dependability of big-engine design. Write today for more information on the new RS Diesel—or for greater power, ask about the well-known S and SS Diesels up to 900 hp. Ingersoll-Rand.

20—See page 43. Superior Diesels: Be sure to read the remarkable success story on page 43 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated booklet, "Superior Diesel For Stationary Application." The National Supply Company, Superior Engine Division.

DUST & FLY ASH COLLECTING EQUIPMENT

21—See page 48. Electrical Precipitation: Write for your free copy of an informative bulletin which presents full information on the Cottrell Precipitator. It effectively cleans stock gases by removing over 95% of all fly ash particles. Research Corporation.

ELECTRICAL EQUIPMENT

22—See pages 10, 11. Circuit Breakers and Switchgear Units: Construction extras make I-T-E Multumite your best Switchgear buy! Advice and assistance in your planning and improvement of your distribution system is yours without obligation. I-T-E Circuit Breaker Co.

23—See page 42. Renewable Fuses: You are invited to write for latest Catalog for more information about Economy "De-Lay" Renewable Fuses, which give safe protection where most overloads occur—in the 135 to 200% range. Economy Fuse and Mfg. Co.

24—See page 148. Exterior Flood-Lighting: Rather than putting your business to bed every night, let it attract new customers for you 24 hours a day. Do it with exterior flood lighting. Puts the spot light on your location and outdoor signs. Guards against intruders. Write for complete information on trouble-free mercury vapor exterior flood lighting installations. Hyre Electric Co.

25—See page 67. Silicone-Glass-Mica Coils: Wherever high heat gives you the problem of burned-out coils, make a study of Class H coils. They fit snug and tight and they last! Their inorganic insulation plus improved ventilation, better heat conductivity, and other special features do the trick. Write for full details. National Electric Coil Company.

(Continued on page 23)

READERS' GUIDE

(Continued from page 22)

FLOOR REPAIRS

26—See page 170. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or complete overlay. Used indoors or out. Dries fast. Send for free trial offer and complete information. No obligation. Flexrock Company.

27—See page 165. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and complete information. Flexrock Co.

FUELS AND FIRING EQUIPMENT

28—See page 135. Chicago Automatic Spreader Stoker: Write for recommendations on Standard Stokers for boilers up to 1,000 HP. New economy of operation. Greater combustion efficiency. The Standard Stoker Co., Inc.

29—See page 34. Oil-Gas Burner Unit: New Type K Burner Unit gives uniform combustion quickly, surely over entire load range. Especially accurate where your steam demands vary sharply over short period. Write for new literature on Enco Type K Unit. The Engineer Company.

HEATING, VENTILATING AND AIR CONDITIONING

30—See page 173. Combustion Equipment: Take advantage of the experience and "know how" of Todd engineers for increased economy and efficiency in the burning of liquid and gaseous fuels. Write for details about your particular problems today. Todd Shipyards Corp.

31—See page 174. Help With Your Air-Moving Job: Now you can take full advantage of Hartzell engineering, longest experienced in the propeller-type fan industry, to work on your air-moving problems. See page 174 for coupon which offers you this free service without obligation. Hartzell Propeller Fan Co.

32—See page 59. Electric Circulation Heaters: Write for Catalog 50 for new, complete data on many of the 15,000 Chromalox electric heaters and equipment. Edwin L. Wiegand Company.

HEAT EXCHANGERS

33—See page 139. Heat Exchangers: Provide faster, more accurate cooling of liquids to specified temperatures. With evaporative principle, they consume less than 5% of water ordinarily used. Send for Bulletin No. 96 for complete details. Niagara Blower Company.

INSTRUMENTS

34—See page 164. Recording Mechanical Counter: Permits a complete analysis of efficiency in terms of hours or minutes. Simplifies studying production flow and determining how to maintain high production level. Write for complete information and illustrated circular S C 18. Streeter-Amet Company.

(Continued on page 24)

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READERS' GUIDE ... CONTINUED ...

(Continued from page 23)

35—See page 168. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

36—See page 52. Instruments: A few of the many specialized instruments available from Weston are illustrated and described in this advertisement. All are designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. Write for Bulletin A-7-B. Weston Electrical Instrument Corp.

37—See page 170. Flow Indicators: Write for Bulletin S-1 for specifications of Ernst Sight Flow Indicators. Bulletin also contains details on gage glass guards of non-breakable plastic, flat gage glasses, caliperated gage glasses, rubber gage glass gaskets, brushes, and glass cutters. Ernst Water Column & Gage Co.

38—See page 2. Automatic Combustion Control: Ask for Bulletin No. 49-605 which gives full particulars on the Hays electrically automatic combustion control system. Save fuel this modern, efficient way. The Hays Corporation.

39—See page 155. Severe Service Thermometers: Ask for Bulletin "E" for full information on the "Princo" thermometer built for those really tough service connections. Ask for prices and description of the new dial thermometer, too. Precision Thermometer & Instrument Company.

40—See page 146. Gage Illuminators: These explosion-proof gage illuminators give you even, no-glare, low cost lighting—no bright spots. Only one small lamp required. Insures faster easier gage reading. Write today for full information. Ask too, for data units on gages and valves. Jerguson Gage & Valve Company.

109—See page 162. Shuntflo Meters for Steam, Air, or Gas: For engineering information and Bulletins 400-F1 and 400-F2, write today. Builders-Providence, Inc.

INSULATION

41—See page 168. Insulating Cement: Write for Bulletin I-79 for complete details on Stic-tite insulation. Cut fuel costs by covering fittings, valves, flanges, and surfaces with this long-lasting, easy-to-apply cement. Refractory & Insulation Corp.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

42—See page 15. Colloidal Graphite: Send for your copy of the New Acheson Bulletin No. 424 on the subject **"dag"** colloidal graphite for industrial lubrication. See how it will pay you to incorporate **"dag"** colloidal graphite into your present lubricants. Acheson Colloids Corp.

43—See pages 35, 36. Nonpareil and Stanoil: Test this guarantee: with each fill of Nonpareil a written guarantee is given that the oil will last as long as the turbine and its acidity will stay below a neutralization number of 0.15 mg. KOH/gm. Also ask about Stanoil, the multi-purpose industrial oil containing an oxidation inhibitor and an anti-foam additive. Standard Oil Company (Indiana).

44—See page 57. 11 Ways to Cut Production Costs: Write for your copy of this free, new booklet which is yours without obligation. You will find handy coupon on page 57. Alemite Corporation.

45—See page 167. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

46—See page 152. Fuel Oil Treatment: Gets rid of sludge deposits in tank lines; won't permit carbon deposits to form on burners; cuts down surface tension—just a few of the services Dacarol performs for you. Write for full information on free fuel oil engineering service. Dacar Chemical Products Co.

47—See page 157. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

MAINTENANCE

48—See page 171. Complete Service for Elevated Water Tanks: 32 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication, "Sound Principles of Water Tank Maintenance and Tank Talk". Dixie Tank and Bridge Co.

49—See page 7. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corp.

50—See page 169. Free Repair Handbook: 40-page guide containing diagrams and instructions for making lasting and economical repairs to concrete floors, plant equipment and machinery. Smooth-On Mfg. Co.

51—See page 142. NEW FREE Handbook: Write for your copy of "Commutator and Slip Ring Maintenance". Contains authoritative information on commutator and slip ring maintenance. Fully illustrated. Forty pages of facts. Ideal Industries, Inc.

MATERIAL HANDLING

52—See page 44. Bulk Materials Handling Systems: Long experience has given Stephens-Adamson Engineers the "know-how" that cracks bulk materials handling problems quickly and economically. Their staff is at your service. Write them today. Stephens-Adamson Mfg. Co.

53—See page 141. Pneumatic Conveyors: Write today for full details proving pneumatic conveyors can reduce your handling costs. You have less labor cost, no material waste, and better working conditions. Dracco Corp.

54—See page 54. "Coal Handling Equipment": If you plan to modernize your present coal storage and handling equipment or to install a new system, you'll find this G-W Bulletin No. 300 extremely helpful . . . and most profitable. Write today for your free copy. Gifford-Wood Co.

55—See page 164. Car Pullers, Barge Movers: Electric, gasoline, diesel. Write for full information on power-driven capstans, gypsies, and single and double winches for all materials-handling applications. Silent Hoist & Crane Co.

56—See page 143. Sectional Belt Conveyor: Your own workmen can assemble this sectional belt conveyor in quick time—it's a packaged unit. Variety of truss sections, head sections and A-frame supports let you select a conveyor system suited to your needs. Carefully designed, strongly constructed, curved decking protects return strand of belt. Send today for Bulletin No. 132 for complete information. Robins Conveyors Division of Hewitt Robins Incorporated.

57—See page 49. Bucket Elevators: Newly designed, they give you welded angle casings of heavy gauge steel that are dust and water tight; better head and boot sections; more bearing protection; removable hood; large clean-out and inspection doors. Write for full information. The Jeffrey Manufacturing Company.

PACKINGS AND GASKETS

58—See page 150. Self-Lubricating Packings: Write for Bulletin LP-10 with full information on this complete line of packings. Greene, Tweed & Co.

PIPE AND FITTINGS

59—See page 29. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. Ask for Publication C-24. The American Brass Company.

60—See page 172. Flexible Couplings: Get your copy of this complete catalog and Quick-Finding Selector charts to tell you exactly what coupling is right for any service from 1/6 to 2500 h.p. Lovejoy Flexible Coupling Co.

61—See page 61. Flexible Connections: Write for literature describing available connectors in brass, bronze, aluminum, steel and other metals, in sizes ⅛" to 12" I. D. American Metal Hose Branch of The American Brass Company.

62—See page 169. Pipe Fabricating Specialists: Meet your most exacting specifications with absolute satisfaction on all pipe fabricating for Oil, Chemical, Concrete, Asphalt, and other industrial requirements. Fabricating Division, Albert Pipe Supply Co., Inc.

63—See page 160. "K" Fittings: Close-grained, tough, smooth, symmetrical. Approved by Underwriters' Laboratories. Selected by users where requirements are severe and exacting. Write today for new catalog containing complete data. The Kuhns Brothers Co.

64—See page 131. Ball-Bearing Swivel Joints: Catalog No. 50 gives full information on more than 500 different types, styles and sizes Chiksan Ball-Bearing Swivel Joints. Write today. Chiksan Company.

65—See page 163. Flexible Metallic Hose: Seamless or interlocking, for every known application. Also hose built to your specifications. Write for latest development bulletins. Atlantic Metal Hose Co.

PLANT EQUIPMENT

66—See page 168. Carry-Tool: A new Hallowell time-saver. Sturdy, easy-rolling, handy. Made of heavy-gauge steel with large drawers for tools. Ball-bearing rollers. Write for descriptive literature. Standard Pressed Steel Co.

POWER TRANSMISSION

67—See page 117. V-Belts: The complete Vulco-Rope line with the money-saving "concave side", includes a variety of types designed to fit specific requirements. Write for further information. The Gates Rubber Company.

68—See page 70. Whipcord Endless Belts: Manufactured to meet drive requirements of short centers, small pulley diameters, high speed and smooth operation. Write today for Folder 6868C. Raybestos-Manhattan, Inc.

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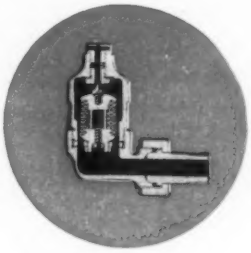
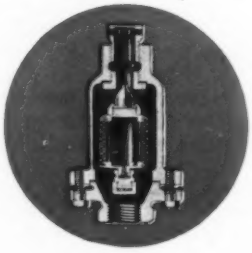
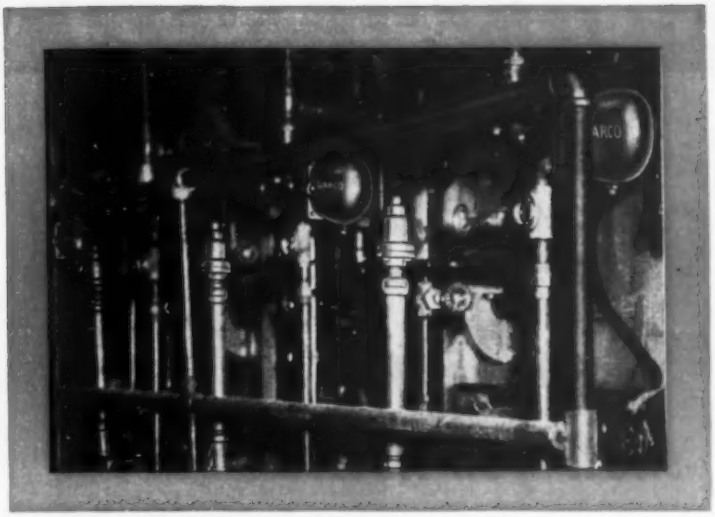
THE *Why* AND *How* OF AIR VENTING







Trapping and venting rotating cylinders of slasher in textile mill

Every steam man knows that air blocks steam lines, but too many executives do not realize what air in the lines and equipment is costing them, and how inexpensive the devices are that can remove it.

There are two vital reasons why air should be removed at the point where it collects.

First—an air steam mixture always has a lower temperature than pure steam at the same pressure. Steam temperature at 15 psi is 249°F, but mixing 50% of air would reduce this to 212°F, equivalent to 0 psi pressure.

Second; and more serious, the air collects on the heated surface and insulates it from the hot steam, reducing output.

THE SOLUTION

First, select the right steam trap. The Sarco No. 9 Thermostatic for instance is wide open when cold. It lets all the initial air out fast. Other Sarcos let air out too, but only at the point where they are installed.

So the next step is to put in Sarco Air Vents at suitable spots in the lines—at the farthest point from entry of steam in process equipment—and at many points in your heating lines.

This is a subject of renewed interest because Sarco has recently designed a complete line of vents and made available special technical data on the subject.

ASK FOR CATALOG No. 275

269

SARCO SAVES STEAM

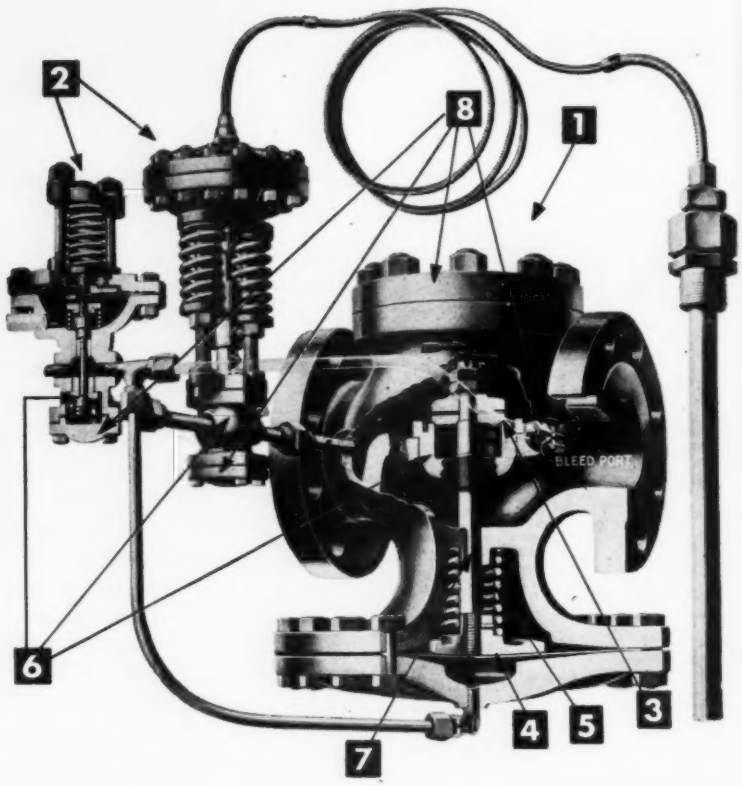
SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

NOW! CUT COSTS OF PRESSURE A

These SPENCE features *show you how:*

YOU SAVE MONEY with Spence Self-Operated Regulators because they function dependably and accurately year after year *without requiring extensive repairs or special attention.* This long trouble-free life means less down-time of the system, less time and money wasted on replacement of parts. Thus, you lower over-all costs and, at the same time, are assured of quality performance.



The cutaway illustration above shows why Spence Regulators . . .

REGULATE ACCURATELY

1 The single-seated *packless* main valve is actuated by a large balanced diaphragm. The construction eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 One or more sensitive pressure or temperature pilots control the main valve.

Because the Spence design minimizes friction, accurate regulation remains unaffected by changes in service conditions or length of service.

STAY ON THE JOB FOR YEARS

3 SECO Metal Seats and Discs resist wiredrawing. More than 20 years of experience with SECO Metal in thousands of installations has failed to produce one single case where SECO Metal has been cut by steam.

4 Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

5 The spring in the Spence Regulator is out of the path of the fluid flowing through the valve. It operates at low unit stress to assure performance over an unusually long life.

REDUCE MAINTENANCE

6 The seat and disc of the main valve and pilot can be cleaned and any working part removed, without taking the main valve out of the line.

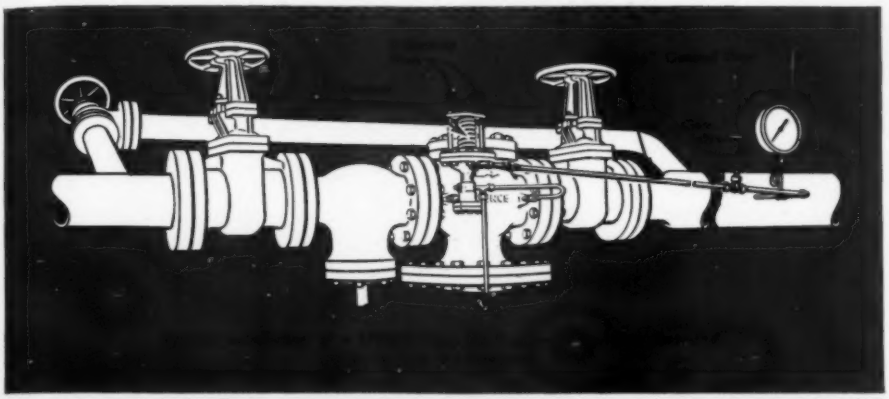
7 All main valves and most pilots are built without stuffing boxes. This packless construction eliminates much time-consuming maintenance.

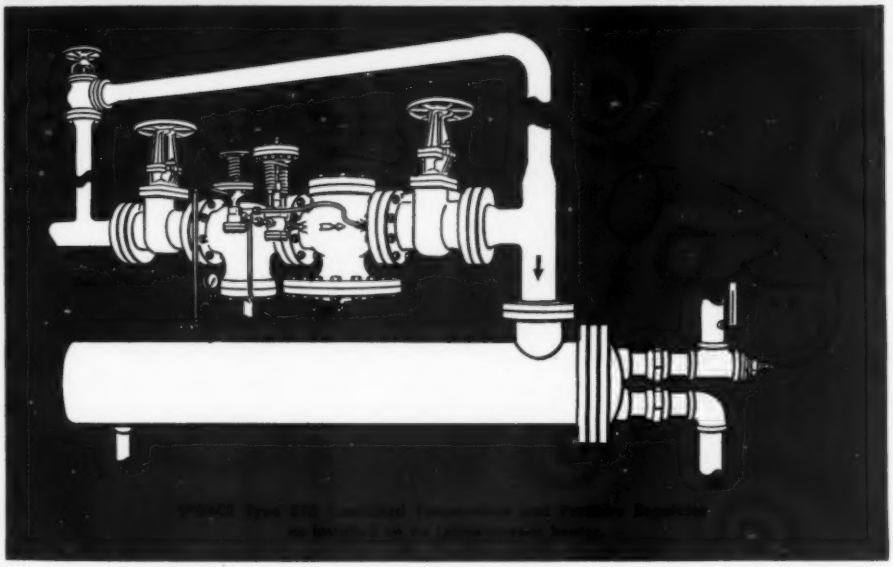
8 No dismantling is necessary to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Special openings are provided. Inspection is easier, too, because the pilot is not an integral part of the main valve.

SPENCE ENGINEERING COMPANY, INC.

RE AND TEMPERATURE CONTROL

TYPICAL INSTALLATIONS





PARTIAL LIST OF USERS

- The Cleveland-Cliffs Iron Company
- Tennessee Coal, Iron and Railroad Company
- The Springs Cotton Mills
- Ford Motor Company
- Cochrane Corporation
- Philadelphia Electric Company
- Pennsylvania Power & Light Company
- L. H. Gilmer Company Div. of United States Rubber Co.
- York Corporation
- Jones & Laughlin Steel Corporation
- The Duluth Steam Corporation
- Rochester Gas and Electric Corporation
- Consolidated Gas Electric Light and Power Company of Baltimore
- Phenix Natural Gas Company
- Cutter Laboratories
- National Tube Company
- The Atlantic Refining Company
- Great Lakes Steel Corporation
- Union Electric Company of Missouri
- Todd Shipyards Corporation
- Oxford Miami Paper Company
- Land O'Lakes Creameries, Inc.
- Ohio Edison Company
- General Electric Company
- R. J. Reynolds Tobacco Company

HAVE UNUSUAL VERSATILITY

9 The Spence Regulator, due to its unique design, will serve many functions and will handle all the various types of fluids under a wide range of service conditions. One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

Spence Regulators are built in sizes from 1/4" to 12" for service with air, steam, water, oil or gas. With minor adjustments, any Spence Regulator can be easily switched from one service to another.

FREE BULLETIN gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today.

9

TYPICAL PRESSURE PILOT MODIFICATIONS AVAILABLE

Type	Delivery Pressure Range, PSI	Normal Accuracy + or —
D	3-150	1 PSI
D5	1-25	½ PSI
W	0-10	¼ PSI
W7	0-3	½ OZ

Spence

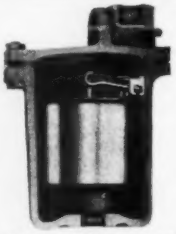
C. WALDEN, NEW YORK

Anyway you figure it....

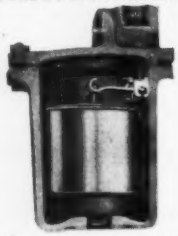
You get TWICE the VALUE with...

Clark DUO-STEP Leverage STEAM TRAPS

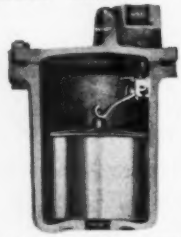
HERE'S HOW DUO-STEP WORKS:



1. Shows orifice closed.



2. First fulcrum point "cracks" orifice.



3. Second fulcrum point moves valve from orifice.

The amazing new Clark Duo-Step design actually *doubles* the drainage capacity of Clark Steam Traps. This means *double value* anyway you figure it. Now you can use smaller, less expensive traps for larger drainage jobs or get *twice* the drainage from traps you have been using.

Sound good? It is! Better look into Clark Duo-Step *today* and start saving real money on your steam trap requirements.

THE CLARK MANUFACTURING COMPANY
1846 East 38th St., Cleveland 14, Ohio

GET THE WHOLE AMAZING STORY, SEND FOR THIS BOOKLET -Today!

Clark DUO-STEP Leverage

Clark FLUID CONTROLS

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(Continued from page 24)

69—See page 156. Bearing Bronze Castings and Bar Stock. Up to 19" OD, up to 20" long cored, up to 40" long solid are produced by an exclusive Die-Cast process. No patterns or core boxes needed, completely free of blow holes and burn-in sand. Complete weight chart and Special Services Bulletin 150 will be sent on request. Magnolia Metal Co.

70—See page 165. Worm Gear Speed Reducers: New vertical speed reducer designed specifically for agitators and mixers and for use with supplementary low-speed spur gear drives without outboard bearings. Write today for Bulletin 125. The Cleveland Worm & Gear Co.

71—See page 17. Diamond Roller Chains: They insure successful uniform performance when you have heavy lifting, skidding, bending, tightening, or moving jobs to do. Diamond Chain Co., Inc.

72—See page 53. Multi-V-Drive: Write for latest bulletin on Worthington Multi-V-Drives—gives you full explanation of how 15 exclusive, or original, features including the Worthington QD Sheaves will save you money. Send today. Multi-V-Drive Sales Division, Worthington Pump and Machinery Corporation.

PUMPS

73—See page 123. Unipumps: Suitable for applications requiring minimum overall dimensions, pumps are offered in capacities ranging from 10 to 1000 gpm against heads up to 500 ft. Send for descriptive literature. The Weinman Pump Mfg. Co.

74—See page 66. "How To Get Longer Service From Your Pumps": That's the title of a new booklet that belongs in the files of every man concerned with operating, maintaining, or purchasing pumping equipment. Be sure to write for your copy now. The International Nickel Co., Inc.

REGULATORS AND CONTROLS

75—See pages 26, 27. Pressure and Temperature Control: Free Bulletin gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today. Spence Engineering Co., Inc.

76—See page 133. Pressure Regulators: Masoneilan Regulators are giving accurate pressure reducing service in various types of applications. The No. 227 regulator, for instance, accurately maintains uniform industrial water pressures. The No. 33 regulator furnishes economical pressure control for steam and air service. Write for more information on regulating problems you may have. Mason-Neilan Regulator Co.

77—See page 68. Thermostat and Diaphragm Regulating Valve: New Leslie thermostat features greatly increased throttling range, bi-metallic element, simple, rugged construction. All work together for economic reliable control of cooling water. Write for Bulletin 464-B. It gives complete descriptions. Leslie Co.

(Continued on page 30)

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No. 3

Quick Quiz on Copper Piping

Q **Isn't copper tubing more expensive to use than piping made of other materials?**

A In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tubes prove to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

Q **Why is copper tube easier to install?**

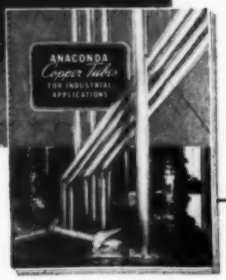
A There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

Q **Are changes in piping systems easier to make where copper tubing is used?**

A Decidedly so, in very many cases. As you know, a badly rusted threaded pipe joint is sometimes almost impossible to uncouple without breaking the pipe or coupling. With ANACONDA Copper Tubes no such difficulty occurs.

Q **Where can I get more facts?**

A A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," can be had on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.



For better Piping...use ANACONDA® COPPER TUBES

READERS' GUIDE

(Continued from page 28)

78—See page 63. Swartwout Control Bulletins: Write for Bulletins S-15-A and S-208A for detailed information on how L-1 control keeps condensate level within plus or minus ½" in horizontal subcooled heaters without manual readjustment! The Swartwout Company.

79—See page 25. Traps and Controls: Catalog No. 275 gives you technical data on equipment that removes air from steam lines. Write for your copy today. Sarco Company, Inc.

80—See page 153. Temperature Indicating Regulators: Combine the advantages of easy-to-read dial thermometer with dependable, self-operating regulator. Easy to install. Write for Bulletin 329. The Powers Regulator Co.

STEAM TURBINES AND ENGINES

81—See page 30. Steam Engines: Cut your power costs by putting steam fully to work. Use exhaust from the Troy-Engberg Steam Engine for your processing or heating, or both. Send for your copy of Bulletin 306. Troy Engine & Machine Co.

82—See page 19. Turbines: Write for Bulletin 135 which explains the pilot operated excess speed safety trip which only Coppus Turbines offer you for extra protection for your turbine investments. Coppus Engineering Corp.

83—See page 62. Terry Turbines: Any Terry district representative will gladly give you full information on a turbine to meet your requirements, no matter how special they may be. Or write directly. No obligation. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

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85—See page 145. Tube Cleaners: New ROTOJET cleaners, air or water-driven models, for practically any size straight or curved tubes. Use less power. Write for more details and prices. Elliott Company—Roto Division.

86—See page 6. PROTO "Wrenchund": 45.6% longer than standard wrenches. PROTO l-o-n-g wrenches give greater leverage, holding power, clearance and reach. Write for details and catalog. Proto Tool Company.

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(Continued on page 32)

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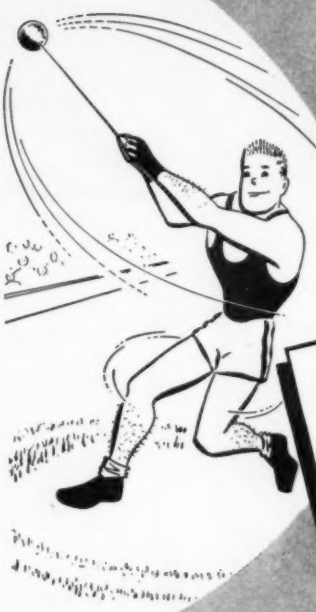

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1. HIGH STARTING TORQUE

Smooth... positive... powerful—that describes a Duplex Steam Engine starting under full load. No clutch—no gear shift—no torque converter... just steady, continuous, direct power as your load comes up to speed—as slow or as fast as you require.

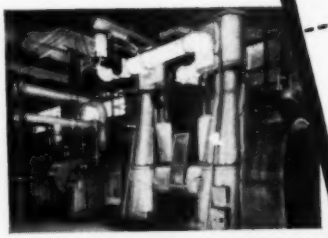
Plus

2 UTMOST FLEXIBILITY

3 SIMPLICITY, LONG LIFE

4 ACCURATE, FAST SPEED CONTROL

5 BY-PRODUCT POWER



Up to speed without a falter: This 300 hp. Troy Duplex Steam Engine brings a positive displacement blower up to speed smoothly, dependably, without jolts or surges. The constant torque characteristic of the engine is also ideally suited to this load.

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the modern Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

Send for Bulletin 306

TROY

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Power Equipment Division

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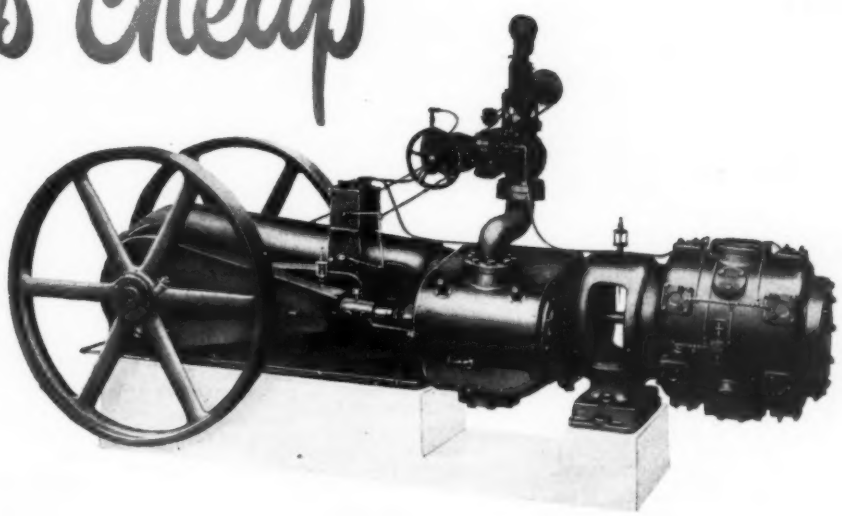
where steam is cheap



class T-S is the ideal compressor *for small capacities*

Where steam is available at low cost, or where exhaust steam can be utilized, Chicago Pneumatic Class T-S steam-driven compressors are most satisfactory. The governor automatically varies operating speed to suit air demands, reducing wear, lengthening machine life, and minimizing operating and maintenance costs.

Of horizontal, straight-line, double-acting construction, Class T-S Compressors are furnished in a variety of steam cylinder sizes for a wide range of boiler or exhaust pressures. Outstanding features include Simplate valves . . . large, smooth air passages . . . liberally water-jacketed cylinder and heads . . . completely enclosed frame . . . one-piece crosshead . . . double-counterweighted crankshaft.

Capacities range from 89 to 1990 c.f.m., with pressures from 10 to 5,000 pounds. Other types are available for larger capacities. Write for descriptive literature.

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(Continued from page 30)

89—See page 13. Masonry Saws: Write today for free trial offer and full information on Clipper's complete, 1950 line of masonry saws. These let you make your own special shapes from standard refractory stock—do the job for you economically on quick-time, and save you money. Cut wet or dry—there's a blade for every job. Clipper Mfg. Co.

TRAPS, STRAINERS AND SEPARATORS

90—See page 55. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

91—See page 137. Trap With No Moving Parts: Provides continuous and complete air and condensate elimination, and visual operation indicator; requires no by pass; fits into line like a valve. Write for Drainator Catalog. The Coe Mfg. Co.

92—See page 157. Airxpel Steam Trap Steel Body and Cover: Approved by California State Department of Labor for use in petroleum refining plants. With increasing acceptance in chemical processing plants and for all types of marine service, this Wright Austin steam trap provides an extra factor of safety in accordance with current insurance codes, for all plants using steam. Send for Bulletin 604 with complete data and prices. Wright Austin Company.

93—See page 121. Thermostatic Traps and Control Valves: Available Catalogs Numbers 250 and 546 furnish complete data on traps and control valves for air, steam, oil, gas, tar or water. W. H. Nicholson & Co.

94—See page 175. Impulse Steam Trap: Discharge continuously under heavy loads, quickly bringing equipment to operating temperature. Keep equipment at peak efficiency by discharging condensate at short intervals, rather than waiting for quantities of it to collect. Small size, easy maintenance, low cost. Write for more details. Yarnall-Waring Co.

95—See page 127. Steam Traps: Trouble-free operation and a single source of supply let's you save on maintenance costs. These units are designed for easy clean-out. Hoffman Specialty Company.

96—See page 28. Steam Traps: Unique Duo-Step design doubles drainage capacity to give you double value—lets you use smaller, less expensive traps to do larger drainage jobs. Send for new booklet today. The Clark Manufacturing Company.

VALVES

97—See page 158. Slide and Butterfly Valves: Rockwell designs many valves for special applications. Your inquiries are invited. Also send for catalog describing complete line of standard valves to 84" pipe size—manual or automatic controls. W. S. Rockwell Company.

98—See pages 46, 47. Blow-Off Valves: A line of blow-off valves designed to meet all draining and blow-down requirements. Write for Bulletin B-432 for pressures up to 2500 lbs. Bulletin B-424 for pressures to 400 psi. Yarnall-Waring Company.

99—See page 3. Automatic Valves: Non-return stop and check valves, pressure reducing valves and back pressure valves available in sizes to keep your manifold heating service out of trouble. Other Foster valves for every type of service. Write for more details and help with your engineering problems. Foster Engineering Company.

100—See page 8. Piping Layouts: A new book of Jenkins Practical Piping Layouts—Nos. 26 to 50—is in preparation. Write now to reserve your copy. Jenkins Bros.

101—See page 65. New Valve Design: Chapman Valve List 960 has been improved to give more than 50% increase in strength of stem and wedge gate connection. Valve stems and gates with new connections are interchangeable with all List 960 valves now in service. Write for complete information. The Chapman Valve Mfg. Co.

102—See page 41. Clip-Type Valves: "King-Clip" Valve, in twenty-one different patterns, now available for a wide range of service conditions in virtually all industries. Write for Circular No. 561 for complete information. The Lunkenheimer Co.

103—See page 60. Drop Forged Steel Gate Valves: Series 12100 for 150-800 pounds service. ¼" to 2", has round bolted bonnet, bolted gland. Henry Vogt Machine Co.

104—See page 163. Multiport Valves: Use electrically operated H&T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

WELDING EQUIPMENT

105—See page 40. Prest-O-Weld Blowpipe and Cutting Attachment: W-111 Blowpipe quickly, easily handles welding job—light sheet to thickest casting. CW-111 Cutting Attachment adapts it for cutting and shaping steel up to 4 inches thick. Attachment and 17 different lengths welding heads fit same handle making switch from welding tube to cutting simple and time-saving. The Linde Air Products Company.

MISCELLANEOUS

106—See page 23. Automatic Printing Calculator: The only calculator that multiplies and subtracts, and prints every factor and answer on the tape for **immediate** proof of accuracy plus **permanent** proof for your records. Ask for free copy of booklet "Command Performance." Remington Rand, Inc.

107—See page 69. New Bulletins on Fuller Equipment: 11 new bulletins of major interest to chief and operating engineers, chemists and superintendents in chemical-process industries. Cover conveyors, coolers, compressors, vacuum pumps, feeders, rotary valves, level indicators, aerators, motion safety switches, and slurry valves. Write for your free copies. Fuller Company.

108—See page 171. Combustion Engineering Course: Send for book "Opportunities for the Combustion Expert," which offers a complete outline of the Hays Home Study Course. Hays School of Combustion.

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and save money, too!

If water's scarce in your community, here's a painless way to cut down consumption.

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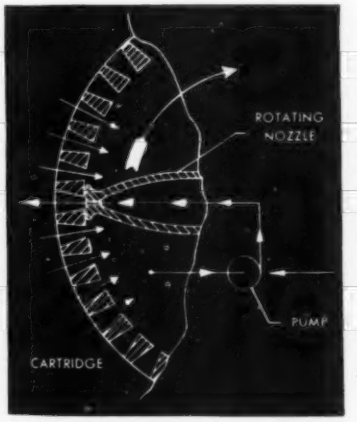
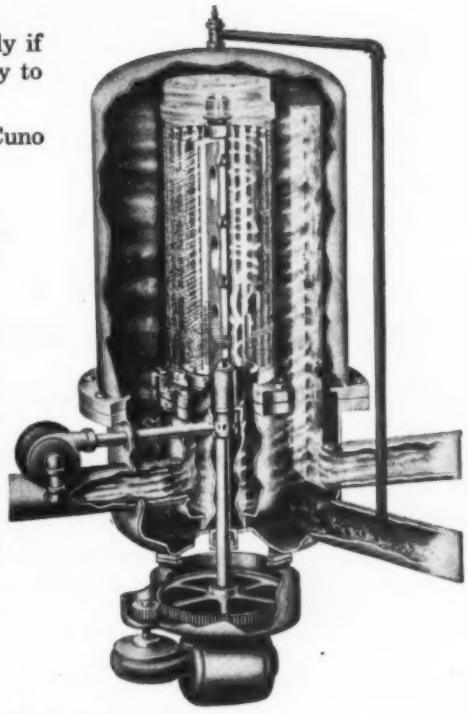
Make dirty water *fit for use* and *re-use* with a Cuno FLO-KLEAN Strainer.



Permanent, Resists Abrasion and Corrosion

Cuno Flo-Klean Filter makes raw water suitable for many plant services . . . keeps recirculated water clean . . . *pays for itself in as short a time as a year.* Permanent wire-wound cartridge positively removes all solids larger than spacing specified.* Pressure drop is exceptionally low because fluid moves in a straight line, encountering only momentary restriction.

**Available spacing from .0025 in. to .020 in.*



Continuously self-cleaning without fluid waste

There is no loss of backwash fluid. Used backwash is returned to the system. With no interruption of flow for cleaning the strainer, no duplex installation is needed. Operation, including sludge removal, may be completely automatic.

Find Out How to Save Money

cleaning any fluids containing abrasives

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Removes More Sizes of Solids from More Types of Fluids

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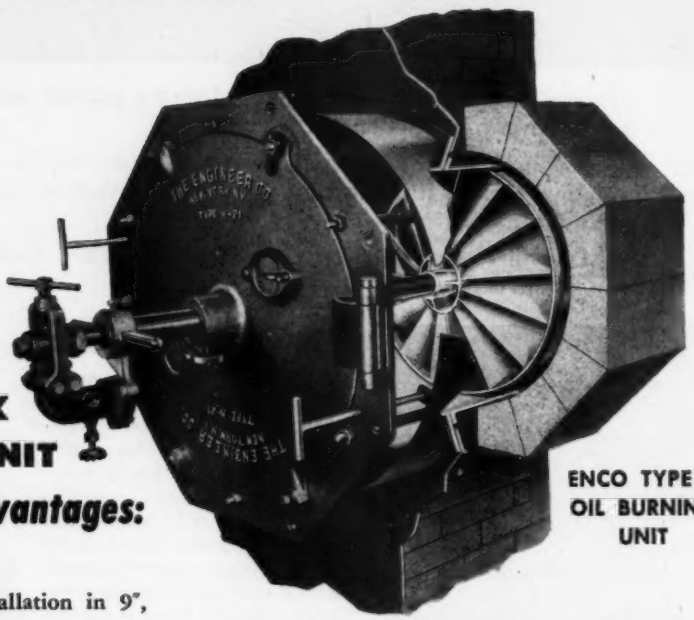
NOW! uniform combustion efficiency from high peaks to low loads with the

ENCO TYPE K

OIL·GAS BURNER UNIT

HERE'S THE LATEST advance in burner units, designed to provide completely uniform combustion over the entire load range. The new ENCO Type K Oil-Gas Burner Unit is especially effective where steam demands swing sharply over short periods.

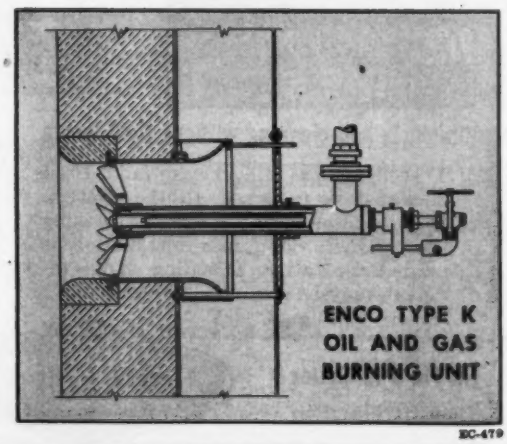


ENCO TYPE K OIL BURNING UNIT

THE ENCO TYPE K OIL·GAS BURNER UNIT *Offers These Additional Advantages:*

1 Natural or forced draft operation.
2 Register draft tube designed for installation in 9", 13½", 18" and 22½" furnace walls.
3 No movable blades.
4 Air vanes provide fixed turbulence over entire load range. Adjustable for long or short flame.
5 Air volume control damper.
6 Hinged door for easy access to internal parts for inspection or removal.
7 Suitable for either steam or mechanical atomizing type oil atomizers.
8 Gas burner gun can be added for combination of gas and/or oil.
9 Comes in a wide range of sizes and capacities.

This new Type K Unit is the result of pioneering research, aimed to help you achieve more efficient, more economical boiler operation. Write today for further information, or see your local Enco Representative.

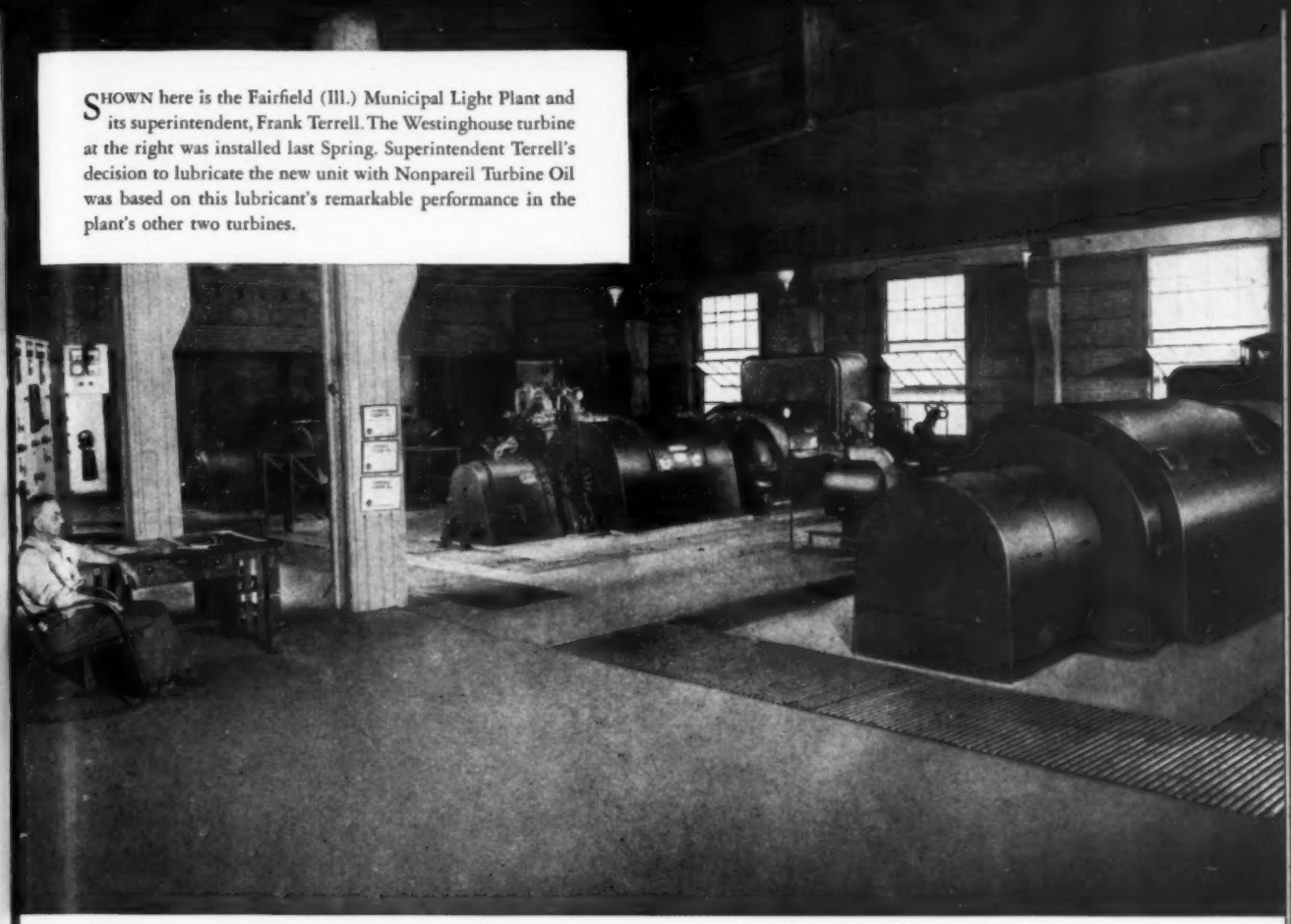


ENCO TYPE K OIL AND GAS BURNING UNIT

EC-479

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.



SHOWN here is the Fairfield (Ill.) Municipal Light Plant and its superintendent, Frank Terrell. The Westinghouse turbine at the right was installed last Spring. Superintendent Terrell's decision to lubricate the new unit with Nonpareil Turbine Oil was based on this lubricant's remarkable performance in the plant's other two turbines.

Here's <u>minimum</u> turbine-oil maintenance

CENTRIFUGING once a year is the only turbine-oil maintenance found necessary at the Fairfield Municipal Light Plant, Fairfield, Illinois. This practice has been followed ever since 1940, when Nonpareil Turbine Oil first went into the plant's new 1500-KW Westinghouse turbine. The same routine has been employed on a second Westinghouse unit of 2500 KW, installed in 1942.

During these 8 and 10 years of operation, the original fills of Nonpareil have not been removed either for treating or for replacing. Neutralization numbers have stayed below 0.08 mg KOH/gm. Oil systems have remained entirely clean.

Such lubricating economy and efficiency is not limited to 10- or 15-year records with Nonpareil Turbine Oil. Each fill of Nonpareil carries a written guarantee that it will remain below a neutralization number of 0.15 mg KOH/gm. *for the life of the turbine* it lubricates. 21-year service records of Nonpareil provide evidence of its ability to end acidity trouble and oil maintenance once and for all.

A Standard Oil Lubrication Engineer will be glad to supply you with actual case histories of utility operations in which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. Your letter will obtain the Engineer's services.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
Turbine Oil

"Will outlast your turbine"

STANDARD OIL COMPANY (INDIANA) STANDARD

Eliminates three out of four hydraulic cleaning jobs . . .

● Once a month these Gage-Matic machines had to be shut down for cleaning of the hydraulic systems. Sticky valves and heavy deposits were a serious problem. The Stephens-Adamson Mfg. Co., Aurora, Illinois, asked a Standard Oil lubrication specialist to solve it.

He recommended using STANOIL Industrial Oil. This is a highly stable product containing an oxidation inhibitor and an anti-foam agent. *It proved to be exactly right for this application.* Valves now operate smoothly and efficiently. Contamination has been minimized. Cleaning of hydraulic systems is necessary now only at three-to-four month intervals.

These benefits are typical of those gained on a wide variety of jobs by STANOIL users. This multi-purpose oil is notable for long oil life and for clean, reliable lubrication of speed reducers, air compressors, and circulating systems. A Standard Oil lubrication specialist will help you take full advantage of STANOIL's versatility. This specialist is located within easy reach of your plant. How you can benefit by his on-the-spot lubrication service is explained at the right.

STANOIL
TRADE MARK
Industrial Oil

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

● William Voegeli, of Standard Oil's Joliet, Illinois office, is the lubrication specialist who helped this customer solve a troublesome hydraulic oil problem. Standard's lubrication specialists are located throughout the Midwest. One of them is within easy reach of your plant. He offers you on-the-spot lubrication service that's backed by extensive experience and training in the use of modern lubricants and fuels. He can help you make important reductions in operating and maintenance costs.

Arrange, today, for a visit of a lubrication specialist by phoning or writing the nearest Standard Oil Company (Indiana) office. Ask him to give you actual performance data on these outstanding products:

STANOIL Industrial Oils—This multi-purpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in air compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

CALUMET Viscous Lubricants—These greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of open gears and chains, better internal lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD

STANDARD OIL COMPANY (INDIANA

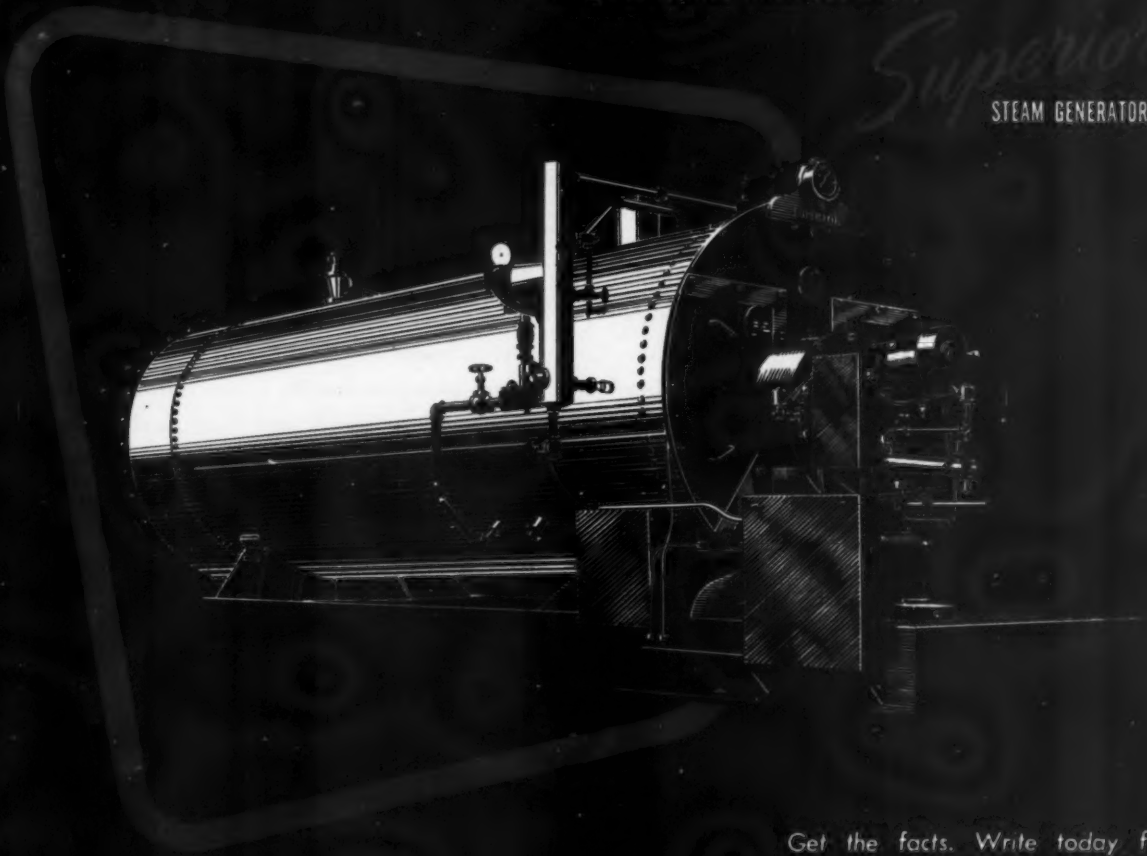
FOR THOSE WHO DEMAND

Something More

. . . than ordinary steam generator performance, SUPERIOR Steam Generators provide the answer . . . and that "something more" is **more** rugged construction; **more** heating surface, **more** steam area, **more** weight per horsepower; **more** accurate control of fuel and air ratios; **more** dependable combustion equipment; **more** years of operation at peak efficiency . . . all of which adds up to 80% or more thermal efficiency which lasts, and lasts. For a steam generator is a long term investment with high dividends when you buy a . . .

Superior

STEAM GENERATOR



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Factory: [illegible] Pa.
Executive Offices: Times Tower, Times Square, New York 18, N. Y.

Job Expediters

W-111 Welding Blowpipe

CW-111
Cutting
Attachment

If you work with metals, there's a spot in your shop for this time- and money-saving PREST-O-WELD combination. For the W-111 Blowpipe easily handles any welding job—from light sheet to thickest casting—and makes fast work of all ordinary heating and forming operations. The CW-111 adapts it for cutting and shaping steel up to 4 inches thick, or for groove-cutting.

Since Cutting Attachment and 17 different lengths of welding heads fit the same blowpipe handle, a switch from welding to cutting or back again is as simple and quick as changing a welding head. No time is lost. You're always ready for any job that comes up.

Your nearby PREST-O-WELD Jobber will be glad to show you how this apparatus helps to reduce equipment inventories, boost production, and cut costs. See him today.

PREST-O-WELD
Trade-Mark

W-111 WELDING BLOWPIPE with
5 Heads and Wrench...$38.00
CW-111 CUTTING ATTACHMENT
with 2 Nozzles.....$29.50

The term "Prest-O-Weld" is a registered trademark of Union Carbide and Carbon Corporation.

Order from your local Jobber

There's a PREST-O-WELD Jobber nearby to serve you promptly. If you don't know him now, write us. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y.

YOU DON'T HAVE TO PAMPER

THE "King-clip" VALVE!

Fig. 1640

Iron Body Bronze Mounted "KING-CLIP" Gate Valve 150 lb. S.P.—200 lb. W.O.G. For steam, water, gas, air, oil and gasoline service.

THIS STURDY IRON BODY GATE VALVE is built to stand the gaff of hard usage. It is a composite of the strong construction of the original "Clip" valve pioneered by Lunkenheimer many years ago and improved design features to meet modern-day conditions. It provides maximum resistance to distortion, piping stresses and wrenching strains.

Aside from its basic rugged proportions, the "KING-CLIP" embodies these distinctive features: • non-corrosive stem-thread bearing cast in bonnet • large drain channels that really drain the bonnet • sharply tapered bronze disc that seats tight • bronze rolled-in seat rings • coarse stuffing box threads that resist corrosion and stripping • hexagon head gland • Lunkenheimer-developed stem material that eliminates stem-thread failure due to wear • easy disassembly for servicing.

Ask for Circular No. 561 which illustrates the numerous patterns in which the "KING-CLIP" is available—iron body trim with bronze and various alloys, and all-iron . . . for a wide variety of services. You'll find one or more types which you can use to profitable advantage.

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save you money . . . and "headaches"!

Distributors' stocks and service are a money-saving and time-conserving convenience. The more you use these handy facilities, the less you need spend for stock-room inventory and "sleuthing" for sources of supply. Call your Lunkenheimer distributor and profit from his unfailing service—not only on valves, but on the numerous other commodities necessary to keep industry in pace with the needs of these fast-moving times.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

The "King-clip" is king of all clip type valves!

NEW ELECTRICAL DEVELOPMENTS #1

This Versatile Performer

CANNOT RISK NEEDLESS INTERRUPTIONS

The new Dialmatic Cleveland, is convertible . . . from a bar machine to a chucker in 30 minutes! Has electrical forward and return feed control of each turret position.

DESERVES

ECONOMY *Dependable Protection*

The more useful a machine is, the more essential it is that it be protected against unnecessary blows and costly stoppages.

ECONOMY RENEWABLE FUSES with ECONOMY "De-Lay" RENEWAL LINKS offer this superior protection where time delay is needed most—namely, the 135% to 200% range in which most overloads occur.

Your Electrical Wholesaler can supply you with the new ECONOMY FUSES and easily-and-quickly-renewed ECONOMY "De-Lay" LINKS.

Send for New Catalog

ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

2592

ECONOMY FUSE & MFG. CO., 2717 GREENVIEW AVE. CHICAGO 14, ILL. REPRESENTATIVES IN ALL PRINCIPAL CITIES

This Power Plant Will Pay For Itself in Two Years

In May 1949 a new Missouri generating plant went into service with three Dual Fuel Superior engines. This new power plant replaced a steam turbine system of the same kilowatt capacity that was only 11 years old. Yet the new system saved $10,000 in its first four months of operation.

BUT that's only the beginning of their savings. Within the next few months pipeline expansion will make natural gas available. And when hooked-up, it will only be necessary to push a button on the engine to switch from oil to gas or gas to oil. This use of gas will about double the savings on power, according to the plant's chief engineer.

Present plans call for adding a fourth Dual Fuel Superior. And when the new unit is placed in service, the plant's rate of savings will increase to the point where its entire cost will be paid off in less than two years.

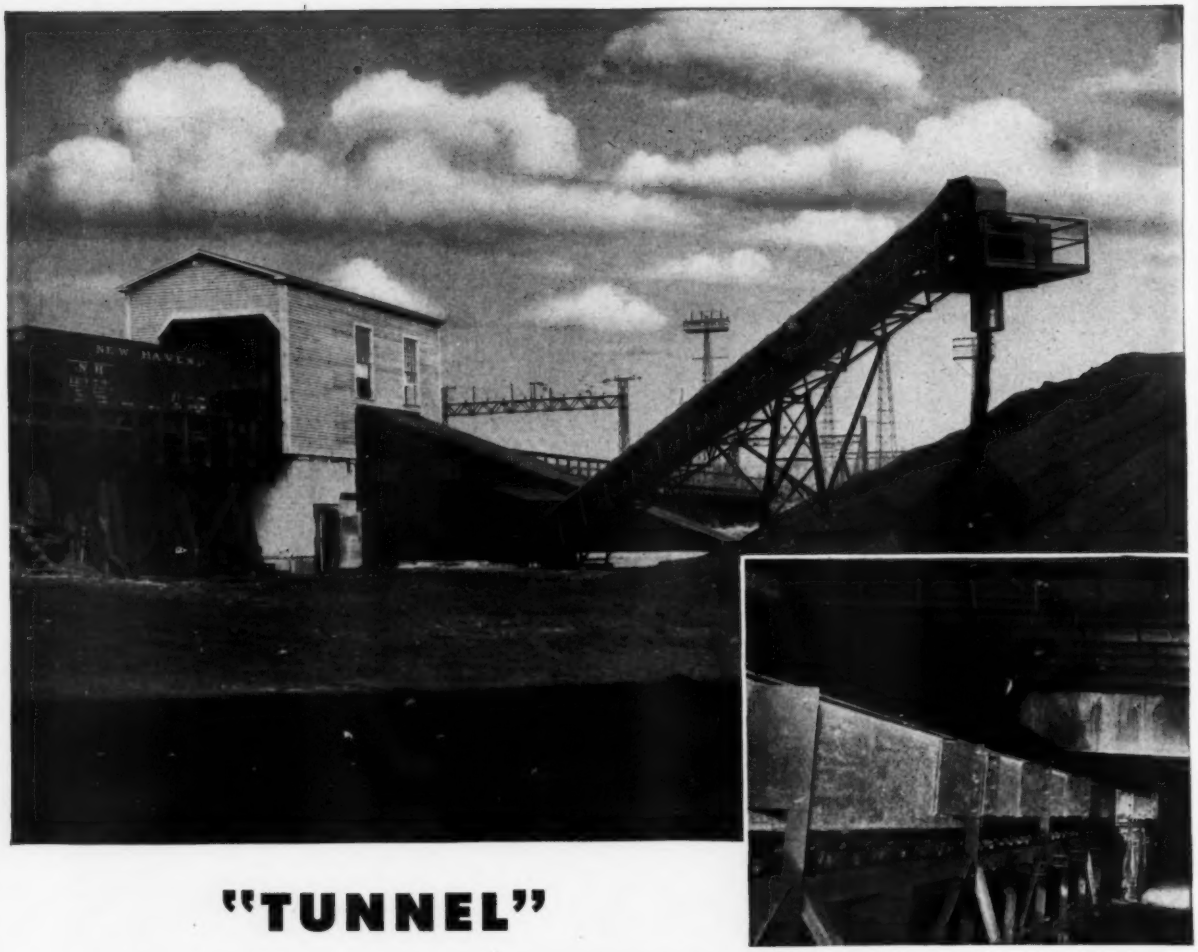
One of our representatives can give you all the details on this and other *Superior* Diesel installations. Chances are, he can help you accomplish the same results. Just write and tell us when he should call. Or, if you prefer, send for our new, fully illustrated booklet, *Superior Diesel for Stationary Application.*

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary



"TUNNEL" FEEDS RAIL POWER HOUSE

Underground pan conveyors operating in a tunnel under the outdoor storage area are a feature of this S-A designed coal handling system. This fast, low cost system permits large storage and easy reclaiming with a minimum of manual effort.

Today, as for the past half a century, leading industries in practically every field, depend on S-A engineers for design and installation of highly efficient handling systems. Designed according to latest engineering principles, to do specific handling jobs, S-A systems for coal and ash handling provide maximum tonnage moved at lowest cost per ton.

While you are in the planning stage of any improvement of your present system or design of a new system, ask first for the recommendations of S-A engineers. There's no obligation . . . write today.

Coal is dumped from hopper-bottom rail cars to receiving hopper for the first step of this S-A designed coal handling system. If boiler house bunkers are full, inclined belt conveyor takes coal to outdoor storage pile. Bulldozer spreads it over a wide area. When boiler house needs coal, bulldozer unit scoops coal into underground reclaiming hopper. S-A inclined pan conveyor, operating in tunnel under coal storage area, returns coal for transport to bunkers.

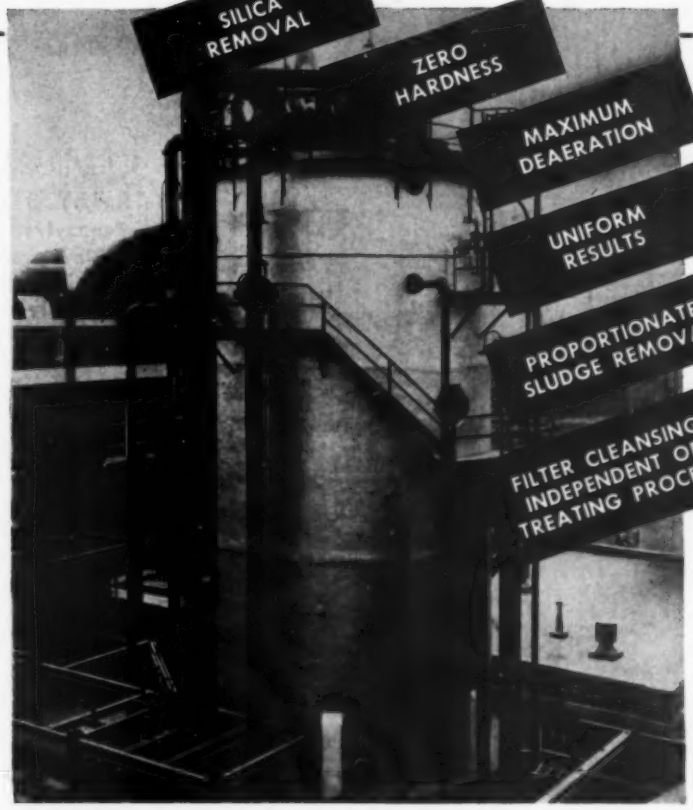
STEPHEN S-A ADAMSON MFG. CO.

21 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

No Other Water Conditioning System Has All of These Features...

...ALL IN ONE TANK:



Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

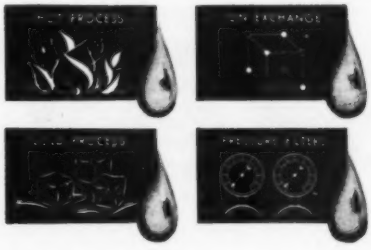
In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N.J.*

Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System

J8-3



WORTHINGTON

WATER CONDITIONING

Worthington Makes More *of the Equipment For All Types of Water Conditioning Systems*

TWO

A FEW REPRESENTATIVE USERS
OF YARWAY BLOW-OFF VALVES

Pennsylvania Power & Light Co.
Cleveland Elec. Illuminating Co.
Connecticut Light & Power Co.
Duke Power Co.
Georgia Power Co.
Lynn Gas & Electric Co.
Pacific Gas & Electric Co.
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American Viscose Co.
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Bethlehem Steel Co.
Celanese Corporation
Eastman Kodak Co.
Fibreboard Products Co.
Gulf States Paper Co.
Lever Bros., Co.
Ohio Oil Co.
Phelps Dodge Corp.
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Yarway Type "B" Seatless Tandem Blow-Off Valve. For pressures to 400 psi. Ask for Bulletin B-424.

YARWAY

REASONS

FOR USING

GOOD BLOW-OFF VALVES

1. **To be sure of *tight* blow-down lines.**

2. **To withstand the severe punishment of regular or emergency blowing-down under pressure and periodic acid wash.**

Yarway Blow-Off Valves are *good* blow-off valves—designed and built to safeguard beyond any doubt your sizeable boiler investment.

To give you drop-tight protection required for efficient boiler operation, Yarway offers Seatless Valves that have no seat to score, wear, clog and leak . . . or heavy-duty Yarway Stellite Hard-Seat Valves.

Either valve, or any tandem combination, also provides ruggedness and safety beyond any emergency requirements.

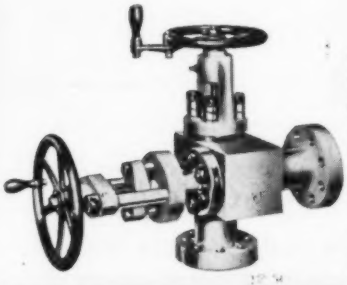
It is no coincidence that more than 15,000 boiler plants throughout the world use Yarway Blow-Off Valves . . . and among high pressure plants, 4 out of every 5 are Yarway-equipped.

For the full story on blow-off valves for *your* boilers, write today for the Yarway Bulletin. *Please mention pressure range.*

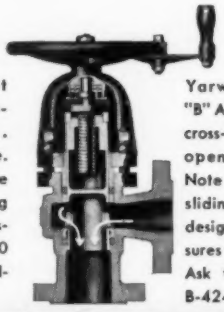
YARNALL-WARING COMPANY

109 Mermaid Avenue, Philadelphia 18, Pa.

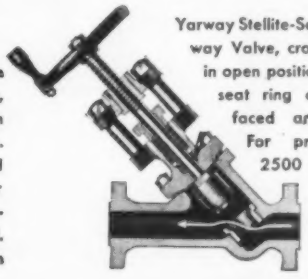
Branch Offices in Principal Cities



Yarway Unit Tandem Blow-Off Valve. Flanged type. Also available with welding ends. For pressures up to 2500 psi. Ask for Bulletin B-432.



Yarway Type "B" Angle Valve, cross-sectioned in open position. Note balanced sliding plunger design. For pressures to 400 psi. Ask for Bulletin B-424.



Yarway Stellite-Seat Straightway Valve, cross-sectioned in open position. Disc and seat ring are stellite-faced and ground. For pressures to 2500 psi. Ask for Bulletin B-432.

All These Were Once
DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations. RC-116

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

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New Improved Design

- Welded Angle Casings —heavy gauge steel Dust tight—Water tight
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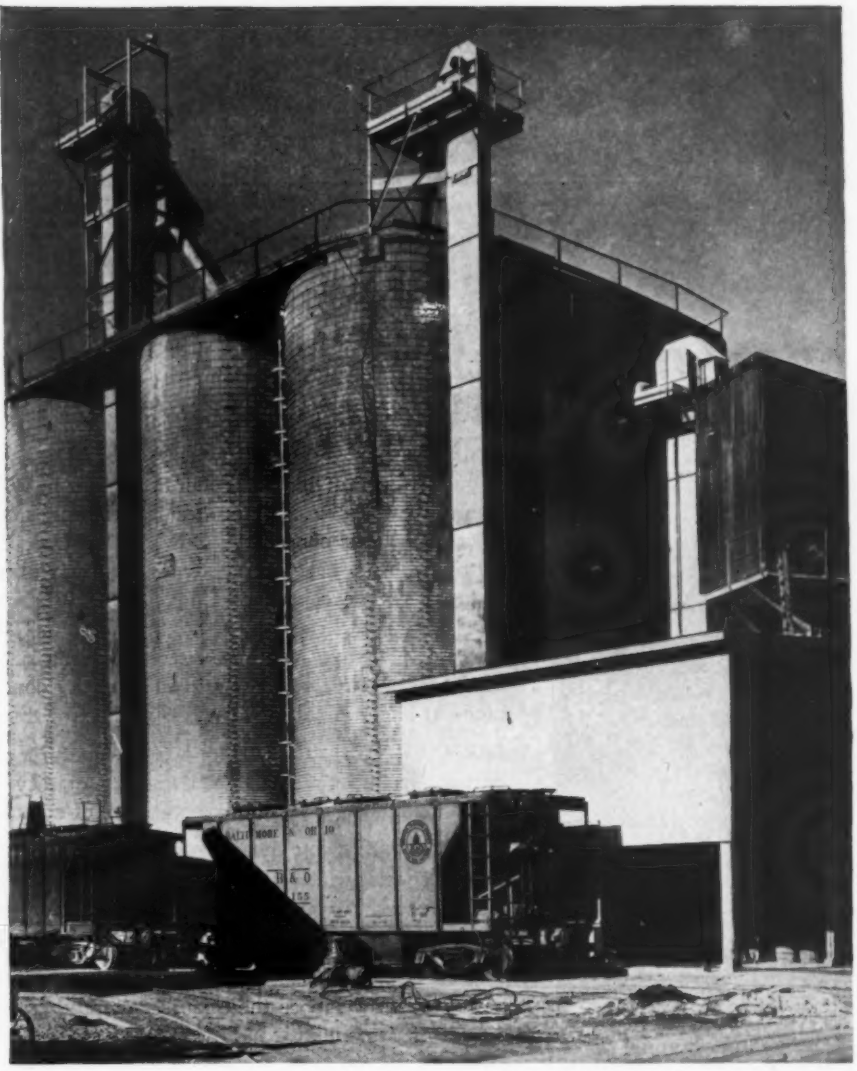
- Increased Bearing Protection
- Removable Hood
- Large Clean-out Doors both sides
- Large Inspection Doors for access to chain and buckets
- Take-ups furnished for Head or Boot if desired—self-aligning, plain or anti-friction bearings



Jeffrey Car Puller is shown in foreground.

These are only some of the features incorporated in our Standard Bucket Elevator line. A type and size to meet any requirement. Complete drawings available. Jeffrey Bucket Elevators are backed by years of engineering experience and hundreds of installations. May we hear from you?

Chains • Conveyors of all kinds • Feeders • Car Pullers • Bin Valves • Dryers and Coolers • Packers • Skip Hoists Screens • Crushers and Pulverizers Belt Idlers • Transmission Machinery Replacement Parts

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Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2	Chicago 1	Detroit 13	Jacksonville 2	Pittsburgh 22
Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
Boston 16	Cleveland 13	Houston 2	New York 7	Salt Lake City 1
Buffalo 2	Denver 2	Huntington 19	Philadelphia 3	Scranton 3

Jeffrey Mfg. Co., Ltd., Head Office & Works: Montreal

6 reasons why

...Industry after Industry has selected the VERTICAL-UNIT BOILER

PARTIAL LIST OF INDUSTRIES THAT HAVE SELECTED THE VU-10 BOILER

AUTOMOBILE
BAKERIES
BREWERIES
CEMENT
CHEMICAL
COLD STORAGE
DAIRIES
DISTILLERIES
FOOD
GLASS
HOSIERY
HOSPITALS
INSTITUTIONS
LAUNDRIES
LEATHER
LINOLEUM
MACHINERY
METALS
OIL
PACKING
PAINT
PAPER
RAILROADS
RUBBER
SCHOOLS
STEEL
SUGAR
TEXTILE
TOBACCO
UTILITY

A glass plant in Ohio . . . a chemical plant in West Virginia . . . a floor covering plant in Delaware . . . plant after plant, representative of virtually every branch of industry, has chosen the C-E Vertical-Unit Boiler, Type VU-10 to meet its particular steam requirements. Here are six important reasons for the VU-10's industry wide acceptance:

Balanced Design — Not one or two features for special needs, but a *completely balanced design* that adapts itself to many conditions. A design in which each element is coordinated with every other for top performance.

Efficient Performance — The VU-10 has high efficiency over a wide range of output, produces steam of satisfactory quality at all ratings and responds to rapid load swings . . . all characteristics of advantage to many industrial plants.

Easy Operation and Maintenance — The VU-10 is simple to operate and maintain — especially advantageous for plants with limited operating and maintenance forces. All parts readily accessible for such cleaning and maintenance work as may be necessary.

Choice of Fuels and Firing — In addition to its wide adaptability, the VU-10 permits you to choose the one *best* method of firing for the fuel and load conditions of *your* plant.

Lower Cost — The standardized balanced design of the Vertical-Unit Boiler effects economies in engineering, fabrication and erection which are passed on to you in lower first cost.

Unified Responsibility — The Vertical-Unit Boiler is a complete unit . . . boiler, furnace setting, fuel-burning equipment, controls, forced draft . . . bringing you the added benefit of one contract, one guarantee and one responsibility.

• • •

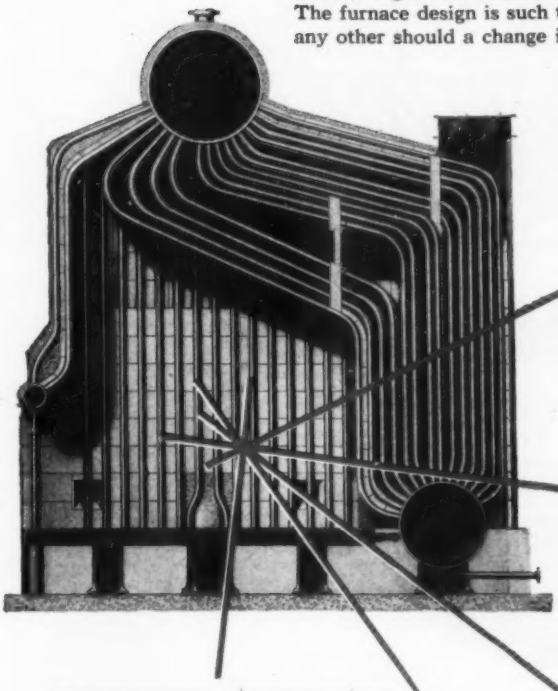
The design, construction and operating features of the VU-10 meet all the requirements of a modern industrial plant. Small wonder so many diverse industries select this unit for their steam needs. If your requirements fall within the capacity range, 10,000 to 60,000 lb of steam per hour, it will pay you to investigate the VU-10. Our engineers will welcome the opportunity to discuss the matter with you or your consultants at your convenience. B-381

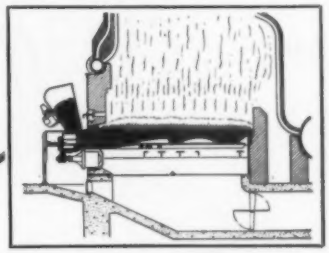
COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

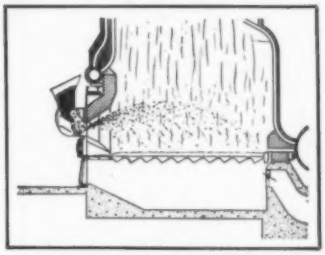
For every fuel market and every type of load there is *one best* method of firing. The selection of that *one best* method for the fuel and load conditions of a particular plant calls for judgment based on broad experience and free from any incentive to favor one type of equipment over another.

The Type VU-10 Boiler is designed for five methods of firing—spreader stoker, single-retort underfeed stoker, chain grate stoker, oil or gas burners. The furnace design is such that any of these methods may be substituted for any other should a change in the fuel market make it advantageous.

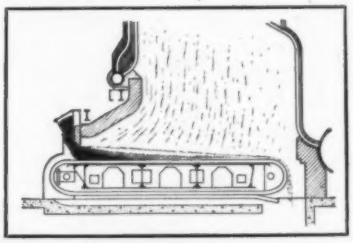




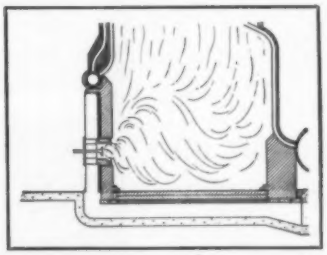
TYPE E UNDERFEED STOKER



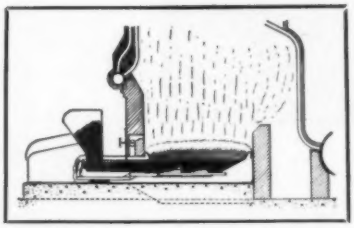
SPREADER STOKER



CHAIN GRATE STOKER



OIL OR GAS BURNERS



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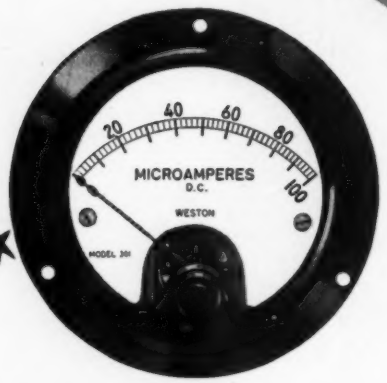

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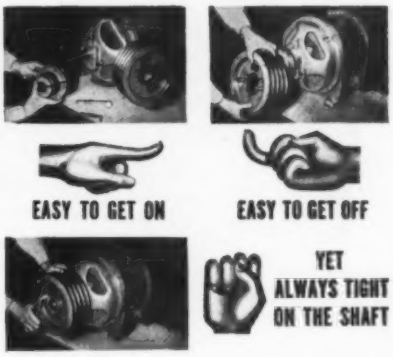
2 Choice of one or two-piece assembly	Mount hub and rim separately, or loosely assemble hub on rim and slide on shaft together	EXCLUSIVE
3 Split hub	Easy to mount, even on oversized shaft	ORIGINAL
4 Clamp screw in hub	Holds hub in position on shaft while setting or removing rim	EXCLUSIVE
5 Taper-mated hub and rim	Mount easily in any position—no keyway between taper surfaces	ORIGINAL
6 Large, long pull-up bolts	Hold better and more uniformly	EXCLUSIVE
7 Friction cone grip	Tightening rim on hub gives positive press fit on shaft	ORIGINAL
8 Shaft key lock (set screw over keyway)	Prevents key from drifting	EXCLUSIVE
9 Quickly-detachable (QD)	Pull-up bolts used as jack screws to remove sheave rim	ORIGINAL
10 Interchangeable rims	Hubs for every bore—lower inventory cost	ORIGINAL
11 No realignment problem	Clamped hub holds shaft position—new rim tightens up in exact alignment	EXCLUSIVE
12 Choice of "A", "B", "C" and "D" grooves	"Tailor-made" grooves give proper belt "ride-out" for maximum life efficiency	ORIGINAL
13 I-beam spokes on driven sheave	Stronger—capable of carrying heavier load with less weight	EXCLUSIVE
14 Offset design of sheave	Reduces over-hang loads—increases bearing life	ORIGINAL
15 Worthington-Goodyear V-belts	Load-carrying cords in neutral axis reduce internal friction—each belt carries its share of drive load	ORIGINAL

How Does Your Drive Rate on the V-drive Scoreboard?

Here are 15 money-saving features of the most efficient V-belt drive. Only Worthington Multi-V-Drives give you all 15!



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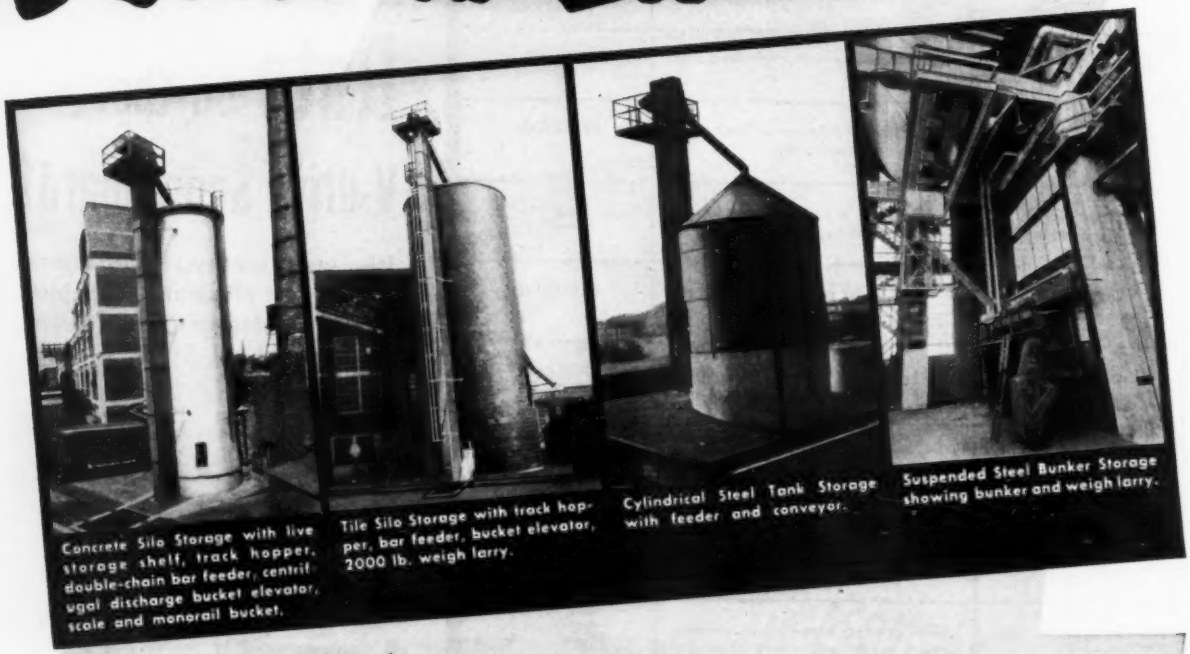
BRINGING YOUR COAL HANDLING COSTS

Down to Earth



Concrete Silo Storage with live storage shelf, track hopper, double-chain bar feeder, centrifugal discharge bucket elevator, scale and monorail bucket.

Tile Silo Storage with track hopper, bar feeder, bucket elevator, 2000 lb. weigh larry.

Cylindrical Steel Tank Storage with feeder and conveyor.

Suspended Steel Bunker Storage showing bunker and weigh larry.

When coal handling costs are too high for comfort, remember Gifford-Wood's 4-basic design story. Each of these storage designs—concrete silo, tile silo, cylindrical steel tank and suspended steel bunker—are carefully engineered to meet specific limitations of climate, capacity, space available and cost. The combination of extensive engineering experience and well known manufacturing ability assures installations of highest possible operating efficiency at reasonable cost.

A Gifford-Wood engineer, thoroughly familiar with coal handling problems, is at your service. Let him study your needs and recommend a G-W system that will both simplify the operation and reduce your costs.

4 BASIC G-W WAYS TO CUT COAL HANDLING COSTS

1. Reinforced Concrete Silo Storage
2. Vitrified Tile Silo Storage
3. Cylindrical Steel Tank Storage
4. Suspended Steel Bunker Storage

Bulletin No. 300 describes, with illustration and working drawing, these 4 basic G-W types of handling systems. Write today for your copy.

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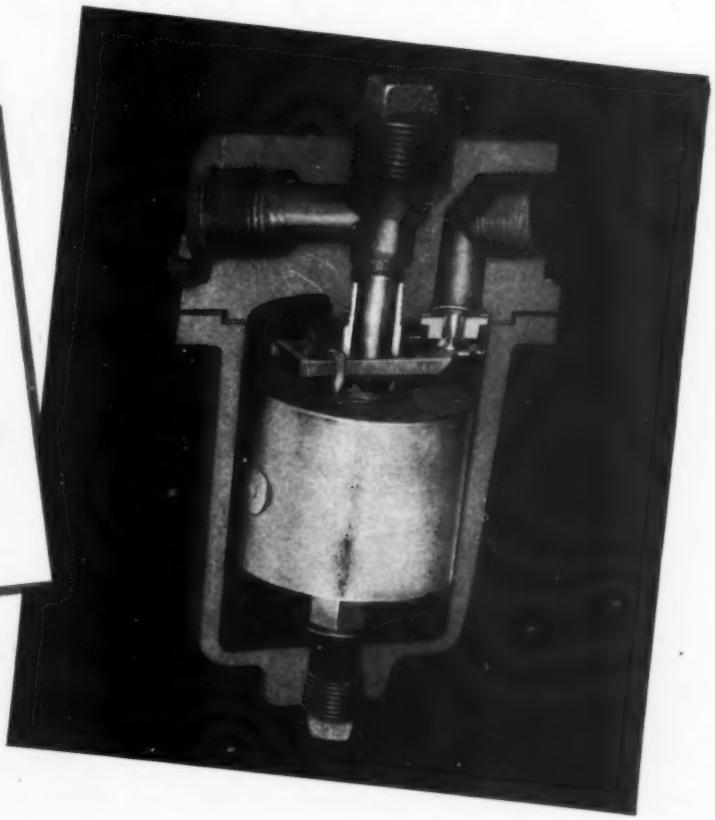
The Inside Story

on WHY YOU SAVE *with* SUPER-SILVERTOP Steam Traps



IN THIS CUTAWAY VIEW of an Anderson Super-Silvertop Steam Trap, you can see that all pipe connections are in the head of the trap. The alternate top inlet connection provides for elbow connection, as well as straight-in-line. This means simplified piping, saving up to nine fittings, plus forty minutes of costly installation time over conventional traps! See how the guided bucket permits the use of a longer lever arm with greater valve opening power. This larger valve means more capacity for the same size trap. Super-Silvertop trapping is efficient trapping . . . *the most economical you can buy.*

You save two ways . . . in installation costs and operating costs. Learn how to cut your steam trapping costs. Write for the helpful book, "Solving Steam Trap Problems."

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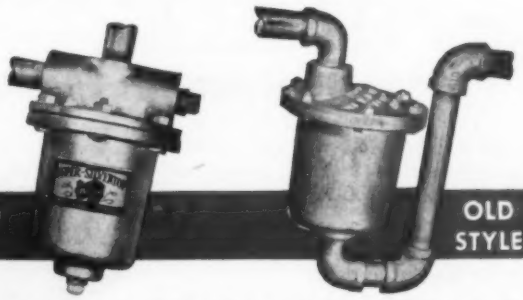

Save Money With SUPER-SILVERTOPS

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Batting Average .350

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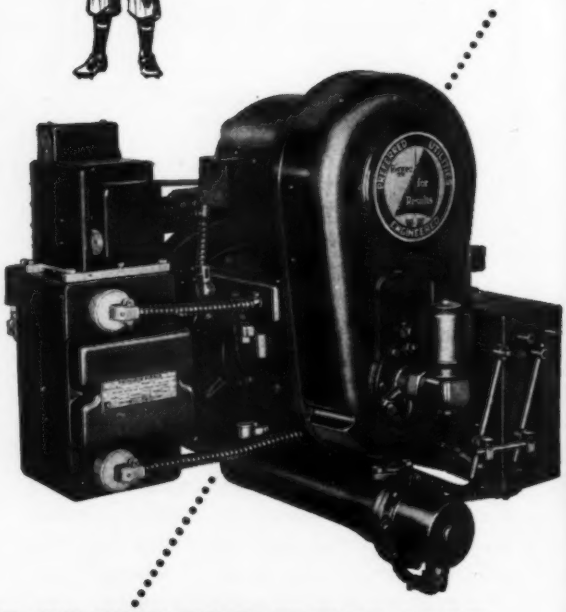
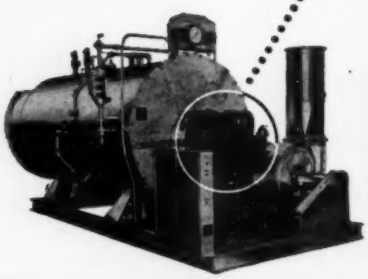
The .350 hitter, of course. He's the "money-player" because of a lot of important *plus* factors . . . a keener eye, better timing, a perfect stance, big-league experience. The same is true in package boilers, too. The Preferred Unit Steam Generator has an important edge because it offers a host of *cost-saving design extras.*

Take the belt-driven 4700 rpm. Horizontal Rotary Oil Burner, for example. It was specially designed by Preferred for firing into the elongated furnace of the Preferred Unit . . . assures *fully automatic operation* even with No. 6 oil and the new catalytic residuals. Its patented Voluvalve exactly meters a predetermined quantity of oil to the burner regardless of changes in temperature, pressure or viscosity.

Want to know more about what makes the Preferred Unit a star performer? Send for Bulletin 1000 giving all the facts.



7 "WORTH-MORE" FEATURES OF THE PREFERRED UNIT



- 4-pass, high velocity, gas travel — minimizes tube cleaning maintenance by self-cleaning action.
- Staggered tube construction — minimizes the possibility of tube pitting, even at *low* firing rates.
- Anti-stress deck for tube sheet protection.
- Self-cleaning *induced draft* fan with air cooled shaft and bearings — built to last 30 years.
- Down-draft gas travel for 80% thermal efficiency — proved and guaranteed.
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- Dual purging cycles for positive elimination of gas stratification.

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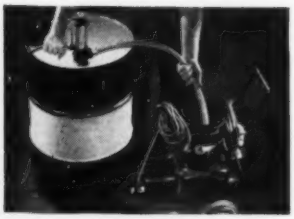
"Treasure hunting" for ways to cut production costs, a leading Philadelphia manufacturer* called in one of our Alemite Lubrication Engineers. His presentation of how to save through more efficient lubrication was timed to take 5 minutes. But it led to the adoption of new methods that are saving the company $9600 a year!

An Alemite System was planned and installed, and immediately began to effect savings three ways: 1. Saving $4.60 per day for labor in lubricating the machines. 2. Cutting bearing failures and replacement costs to the bone. 3. Eliminating "down-time" for lubrication that resulted in $40 worth of added production per day.

No matter what size or type of plant you operate, Alemite can show you dozens of examples of worthwhile savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. Contact your local Alemite Industrial Distributor now. Or send for free booklet "11 Ways to Cut Production Costs." Simply attach coupon below to your letterhead. Alemite, Dept. M-50, 1850 Diversey Parkway, Chicago 14, Ill.

**Name on request*

Alemite Cuts Costs 3 Ways



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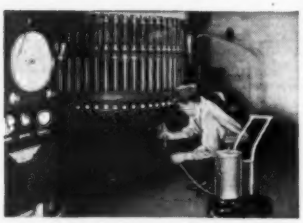
2. ***In Loading Grease Guns . . .*** by saving 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. ***In Applying Lubricants . . .*** by saving up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

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. . . we want HEACON DAMPER applications that will pay for themselves in 6 months.

The Heacon Damper is not just *another* damper. It is designed and engineered to provide the tightest closure possible under all conditions. Each damper is developed to solve a specific problem, each provides the ultimate in control.

The dampers shown on this page all solved specific problems that could have been solved in no other way.

As an example, the second damper from the left above, not only controls 80" w.g. pressure, but also acts as an automatic reverse flow valve that instantly closes and prevents leakage should one of two fans on the boiler fail. The next damper on the right isolates its air heater for maintenance while the boiler continues in service. Such applications save many times their cost, in time and power loss.

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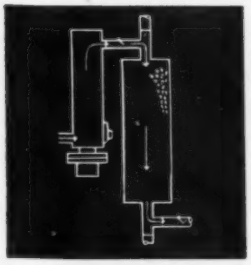
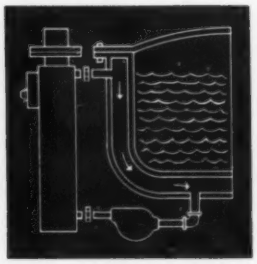


Heating Nitrogen to Reactivate Alumina



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It has complete data on many of the 15,000 Chromalox Electric Heaters and Equipment used in modern industry.

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150-800 POUND

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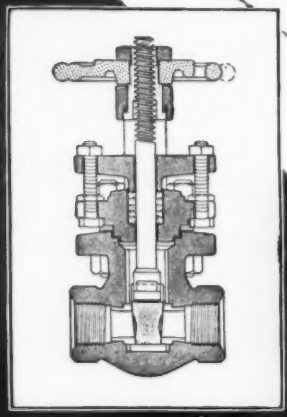

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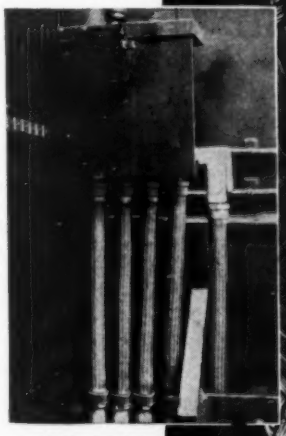
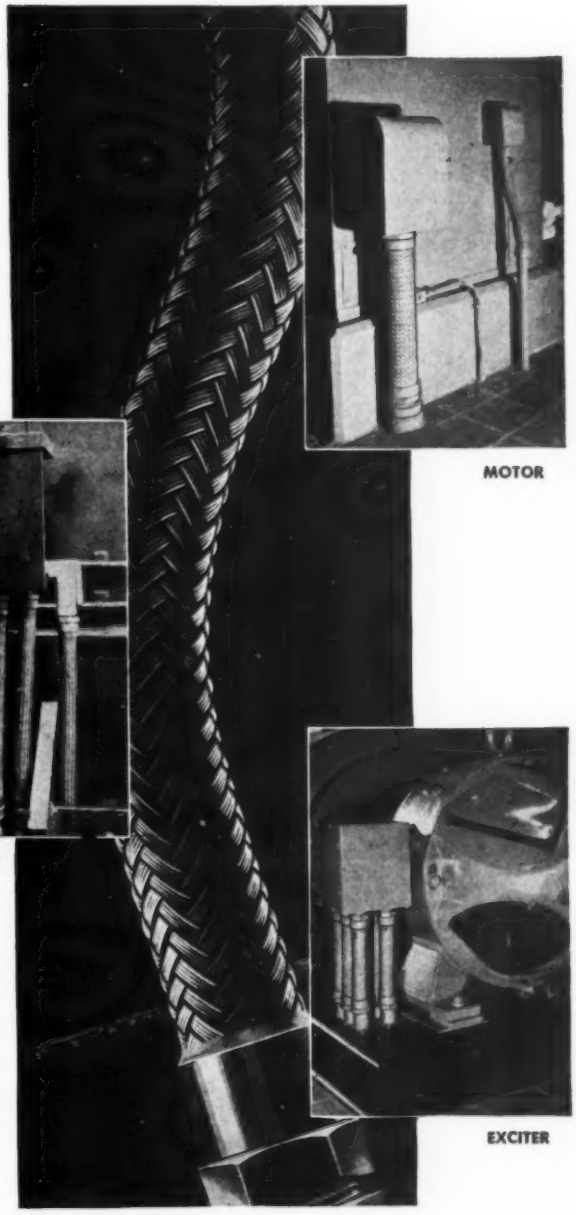
Moisture and mechanical protection, in addition to flexibility at terminal connections, were the primary considerations for some cables at the Public Service Electric and Gas Company, Sewaren Generating Station, Sewaren, N. J. To meet these requirements American Seamless Flexible Metal Tubing was chosen by the design engineers of this utility.



TRANSFORMER



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American "Seamless," in addition to being 100% water-tight, has several "plus" advantages. Alignment ease at rotating units, junction boxes and other equipment simplifies on-the-job installation. Savings in construction costs are an added premium obtained along with the flexible connection provided.

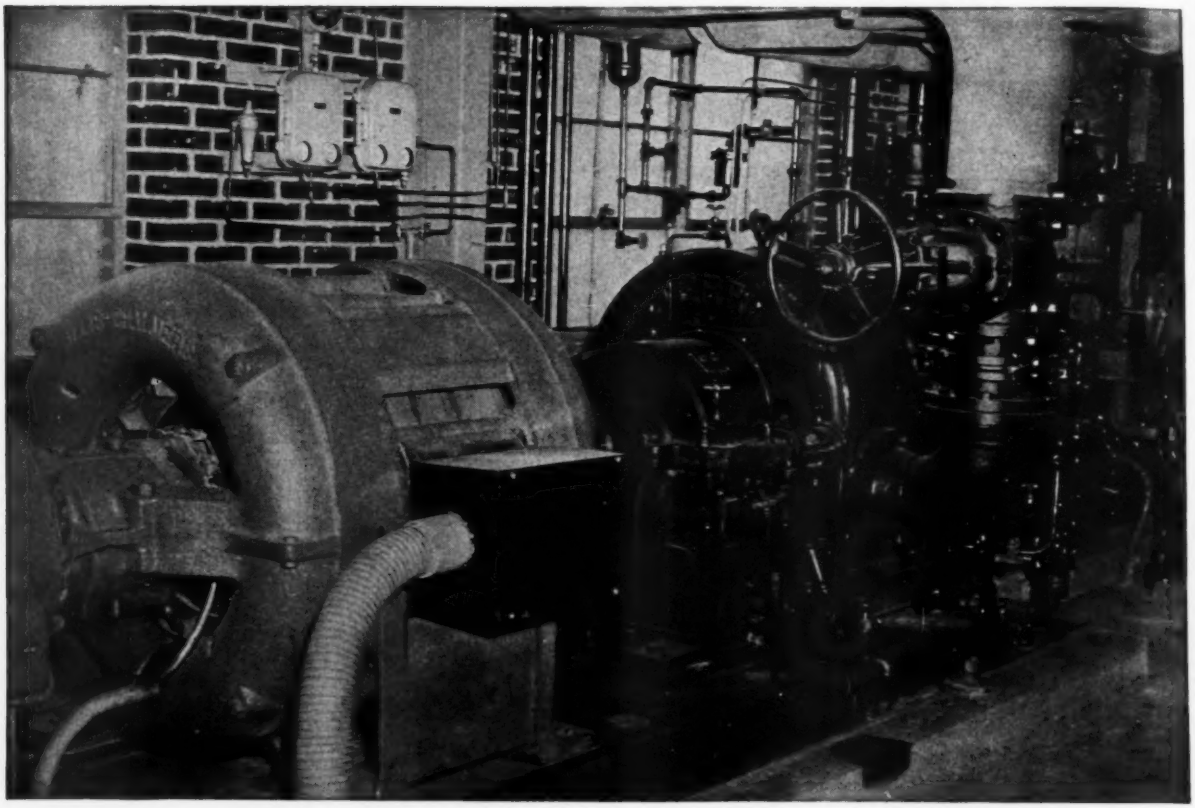
American Flexible Metal Hose and American Seamless Flexible Metal Tubing are made in types for a wide variety of services and conditions. For information, please address The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd. 50248

ANACONDA
from mine to consumer

wherever connectors must move . . . **American**

FLEXIBLE METAL HOSE AND TUBING

The TERRY TURBINE



For By-Product Power and Steam Balance

This 200 kw Terry Turbine driven generating unit operates in parallel with other generating equipment, the load on the unit being adjusted in accordance with the demands for exhaust steam. It is a single stage axial-flow, type, 4500/1200 rpm, 160 psi, 0 superheat, 5 psi back pressure, equipped with Terry reduction gears, oil-relay governor, motor synchronizer and back-pressure regulator.

The installation pictured above is typical of many special applications of Terry Steam Turbines, each designed for specific requirements.

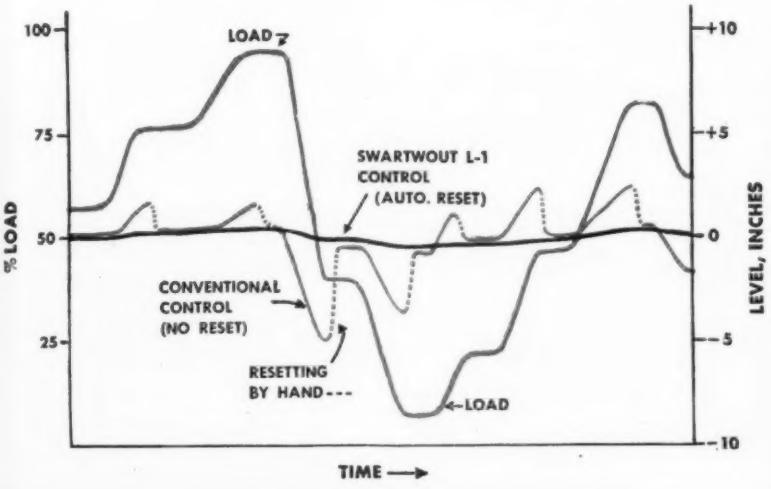
Any of our district representatives will gladly give you full information on a turbine to meet your requirements, no matter how special they may be.

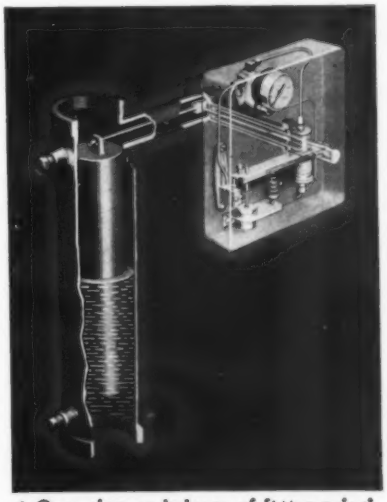
No obligation, of course.

T-1176

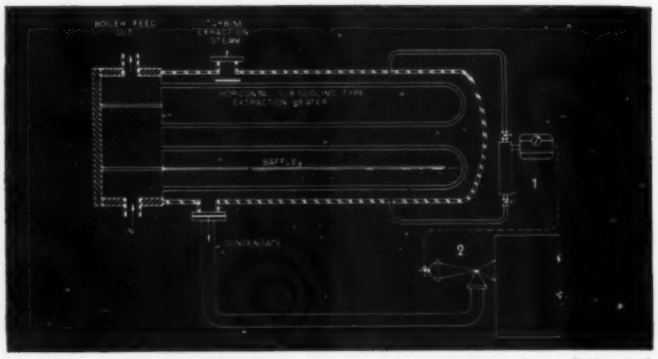
THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

Swartwout L-1 Control maintains condensate level within ±½ inch in horizontal subcooled heaters without manual readjustment!





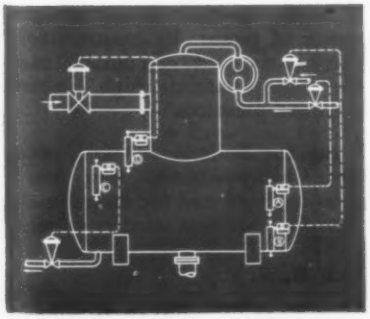
1 Operating on balance of forces principle, Swartwout L-1 Liquid Level Control has little actual movement of parts. Changes in liquid level vary effective weight of buoyant float . . . permit *complete control or throttling over full float length* of from 15 to 120 inches. Reset and setback features automatically compensate for any load condition.



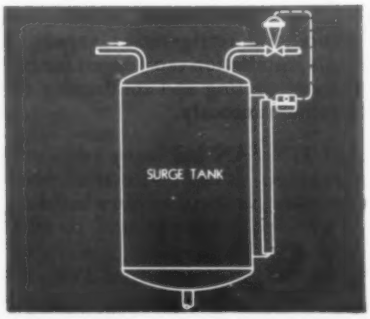
2 Horizontal subcooled heat exchanger *(above)* reduces degradation of heat in extraction steam by cooling condensate below saturation temperature. L-1 Control (1) holds level to ±½ inch for maximum heat extraction at any load. Swartwout V-10 regulating valve (2), with exclusive scroll inlet, withstands punishment of high-velocity flashing condensate.

Swartwout

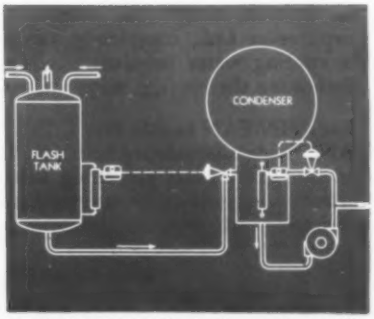
POWER PLANT EQUIPMENT



3 Deaerating Heaters.—Swartwout L-1 Controls are used for normal (A), emergency (B & D), and overflow (C) control. Also used in stage heaters for normal, emergency and by-pass control.



4 Surge Tanks.—Swartwout L-1 Control gives extended range over virtually entire height of tank for maximum "flywheel effect." L-1 Controls are also ideal for storage tanks.



5 Flash Tanks and Condenser Hot Wells.—Flash tank drains to hot well where Swartwout L-1 Control precisely maintains required level by controlling condensate recirculating pump discharge.

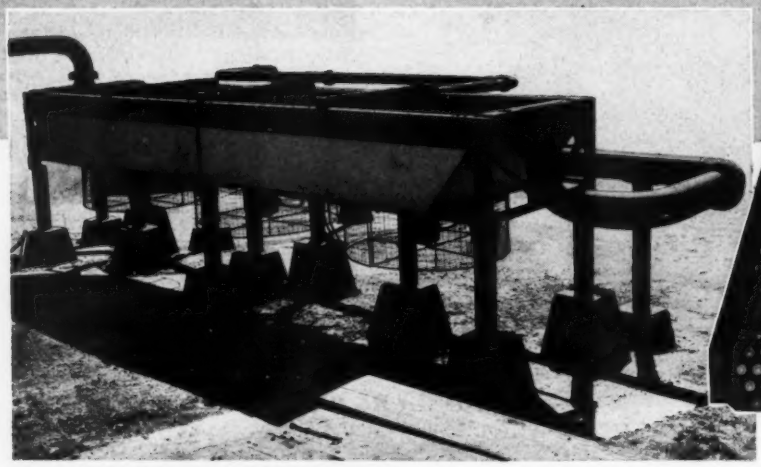
A-2788

SEND FOR BULLETINS S-15-A, S-208A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

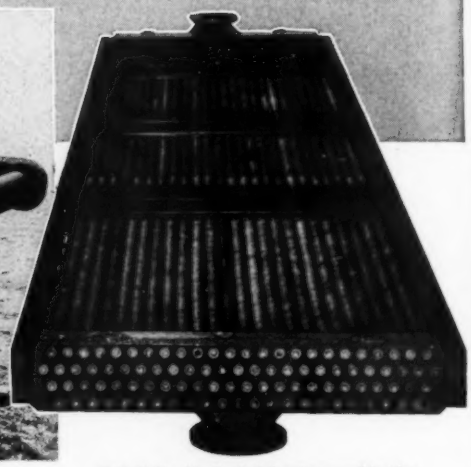
Water Piping
Water Pumps
Water Treatment
Water Disposal
Water Freeze-Up
Water Corrosion

All these water problems and expenses eliminated by FIN-FAN

THE AIR-COOLED EXCHANGER



Single Fin-Fan Exchanger installed on the ground.



G-R K-Fin Air-Cooled Section used in the Fin-Fan Exchanger.

FIN-FAN . . . the *Air-Cooled* Condenser or Cooler developed jointly by The Griscom-Russell Co. and Fluor Corporation Ltd., completely solves the cooling water problem . . . by *eliminating* the cooling water.

That's FIN-FAN benefit No. 1. FIN-FAN'S wide adaptability is its No. 2 benefit. These units are being used for cooling solutions, process liquids, lubricating oil, gear oil, quenching oil, petroleum fractions, jacket water, and compressed gases, and for condensing exhaust steam, hydrocarbon vapors, and refrigerating vapors. A single installation can be used for two or more cooling and condensing duties simultaneously.

And FIN-FAN has many additional advantages. It can be installed wherever convenient . . . within a building, on a roof, or on the ground. Its effectiveness is entirely independent of the direction or velocity of the wind. It can be operated by any available source of power. Its construction is particularly sturdy and durable, capable of withstanding high temperatures and pressures.

Write for Bulletin 1231 describing these many-purpose, many-benefit units in detail and for recommendations for your heat transfer needs.

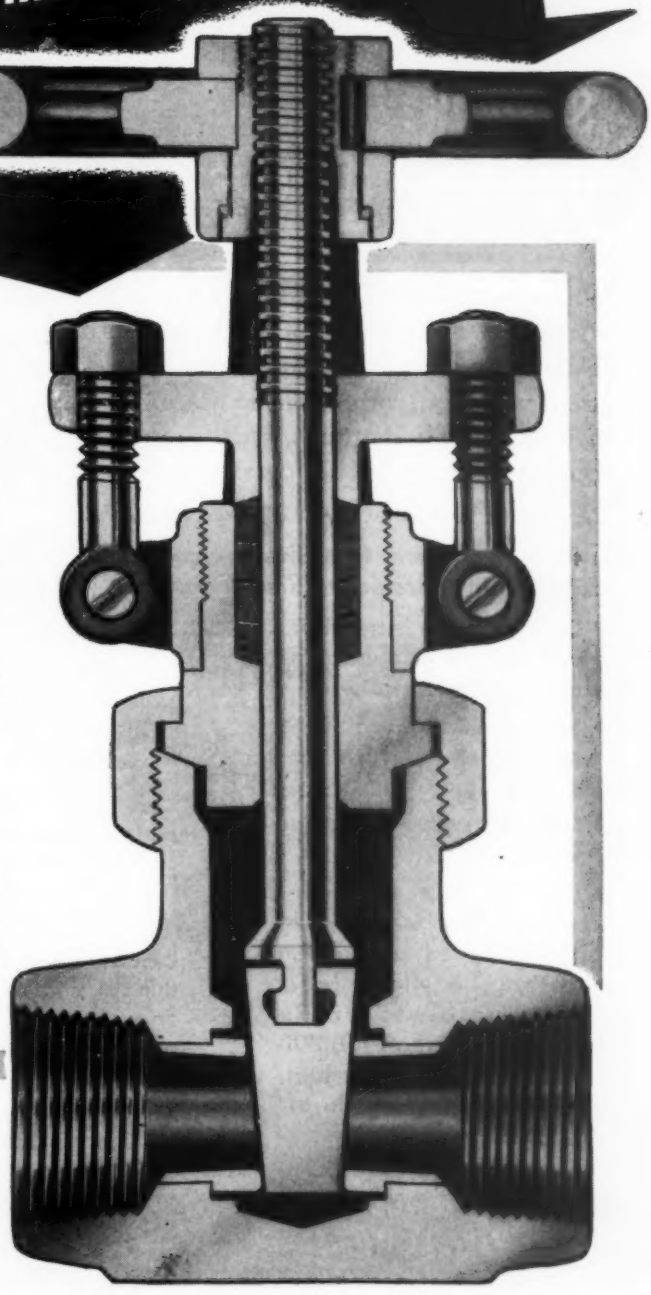
THE GRISCOM-RUSSELL CO., 285 MADISON AVE., NEW YORK 17, N. Y.

GR-250

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

Here's Why You Get Lower Maintenance Costs with Chapman List 960



1. *Gaskets!*
Available with either metal to metal or gasketed joint as required.

2. *50% Stronger!*
New design features compensate at points where excessive strain can develop . . . make stem and wedge gate connection 50% stronger than before.

3. *Wear-Resisting Wedge Faces!*
To keep your maintenance cost down the wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

4. *Replaceable Seat Rings!*
When necessary, you can replace the seat rings easily . . . fast. Seat rings have wear-resisting and non-galling properties . . . made extra hard for years more service.

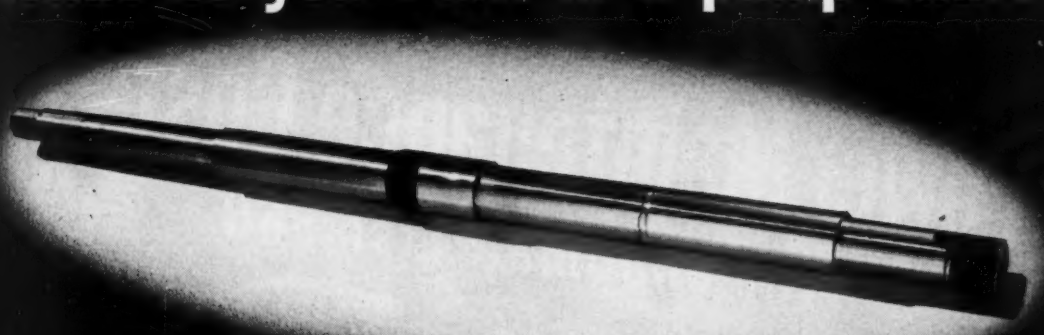
5. *Full Pressure Repacking!*
No need for costly interruption of flow to repack.

But check this lower maintenance cost for yourself. Next time you buy specify List 960 in sizes from ¼" to 2". Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

The CHAPMAN Valve Manufacturing Company

INDIAN ORCHARD • MASSACHUSETTS

What do you want in a pump shaft?



Strength?
Resistance to corrosion? Hardness? Stiffness?

When you specify *Monel* for pump shafts, you get the combination of qualities needed to combat severe service conditions of wear, stress, vibration, corrosion, and heat. *Monel* insures against frequent, costly replacements; cuts maintenance overhead.

Remember...*Monel* has *all* these features:

- **High resistance to corrosion, corrosion-fatigue, and stress-accelerated corrosion.**
- **Exceptional hardness, which means less wear at bearings and journals.**
- **High resistance to fatigue caused by stress, vibration, and pulsation.**
- **Strength equal to that of steel.**
- **And if you need special properties, there is *"R" Monel* for high-speed production machining; *"K" Monel* that is heat-treatable to tensile strength higher than 150,000 psi; *"KR" Monel* that is both free-machining and heat-treatable.**

Monel and the other Inco Nickel Alloys can extend the life of your pumps, valves, gaskets, packing, tanks, heat exchangers and other equipment. For help in solving your power plant corrosion problems, write for "How to get longer service from your pumps." It is free.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

MONEL
solved these difficult problems—

Case 1. In a large metropolitan power plant, the mild steel shaft of a huge circulating pump failed repeatedly because of corrosion-fatigue. Several other metals were tried without success. Then engineers called for "K" Monel. *The result was the world's largest high Nickel alloy pump shaft*—13'x9" dia.!

Case 2. A pump manufacturer had difficulty making long, thin shafts for multi-stage high pressure pumps. Stresses set up during machining caused the shafts to deform and fail in service. Heat-treatable *"K" Monel* was tried—and proved to be the solution to this problem, too.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "L" NICKEL • "Z" NICKEL

are **coil failures** *costing you money?*

look at this record!

18 *failures in 8 years with regular insulation*

Date and Cause of Failure	
2/21/40	Armature coils grounded
12/29/40	Armature coils grounded
9/2/41	Open armature circuit
4/13/42	Armature coils grounded
4/18/42	Leads loose in commutator
10/24/42	Armature band thrown
4/5/43	Armature coils grounded
8/9/43	Open armature circuit
10/7/43	Armature coils grounded
9/30/44	Armature coils grounded
10/18/44	Armature coils grounded
7/28/45	Armature coils grounded
9/14/46	Armature coils grounded
2/6/47	Armature coils grounded
6/23/47	Armature coils grounded
9/17/47	Armature coils grounded
11/4/47	Armature band thrown
12/26/47	Armature coils grounded

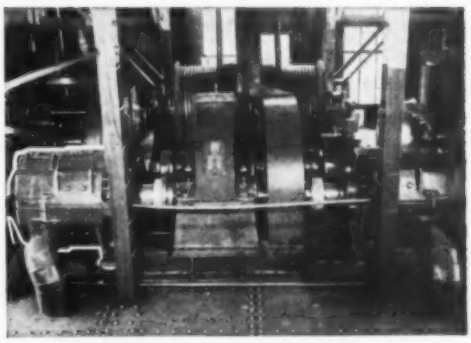
NOT 1 *coil failure in 2 years with National special class H coils*

"Still operating beautifully," is the report *two years after installation* on the National silicone-glass-mica armature coils of the motor shown above. They were installed January 7, 1948, in the National shop. That's quite a record, following the 18 failures in 8 years listed at the right above.

The motor is, of necessity, subjected to terrific abuse, since it is a hoist motor on a huge coal stripping shovel which often bites into solid rock. Excess heat burned out the coils monotonously . . . until National installed the special coils.

Special National Class H coils such as these are building up amazing records wherever high heat is a problem. They utilize silicone, melamine, glass, mica, MICA-GLAS , high-heat varnishes, special solders and other inorganic materials. The insulating materials are made in our plant to our rigid specifications. And all National coils fit snug and tight. They last.

Many armature burn-outs can be avoided by the use of higher grades of insulation. However, all-inorganic insulation isn't always the entire answer. Improved ventilation, better heat conductivity and other factors are also of importance. Your nearby National Field Engineer knows. Write for his name.



Part of the interior of the strip shovel is shown above. The motor outlined is the one which caused so much trouble and expense before National special Class H coils were installed. A larger view of the same motor is shown in the photo at the upper left.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

Reduce Water Bills and Maintenance Costs with the New TRADE LESLIE MARK THERMOSTAT

Specially designed for cooling water service with greatly increased throttling range

It is a recognized fact that water cooled equipment such as air compressors, diesel engines, etc., perform better and require less maintenance if cooling water temperature is accurately maintained. The importance of cooling water control has become accentuated with the growing need for conserving water. The new LESLIE Thermostat and diaphragm Regulating Valve make an ideal Temperature Controller for economic, reliable control of cooling water.

The bi-metallic Thermostat regulates the flow of water (or air) to the diaphragm of the Regulating Valve to maintain a constant water temperature at the bulb location. A slight temperature change repositions the Regulating Valve and regulates the flow of cooling water.

Features of the New LESLIE Thermostat

THROTTLING RANGE—Wide or narrow throttling range can be furnished with adjustable temperature ranges, 32°—400°F and 300°—600°F.

BI-METALLIC ELEMENT—Expansion or contraction of metallic tube provides positive operating force.

SIMPLE—Few moving parts. Simple pilot valve operates without stuffing box or plunger.

RUGGED, RELIABLE—Wear and corrosion-resistant parts give long life. Accuracy of regulation comparable to instrument control.

For small units requiring only ½ or ¾" cooling water supply use the LESLIE Self-Contained Classes MDR, MCR or MBR Temperature Regulators.

LESLIE Thermostat with calibrated dial for easy adjustment

LESLIE Thermostat with 32°-400°F adjustable range

Lowest Overall Cost per Operating Year

Send For — Bulletin 464-B
"Temperature Regulators and Controllers"

50th Anniversary 1900—1950

ESTABLISHED 1900

LESLIE CO.

Look for LESLIE REGULATORS under "Valves" or "Regulators" in your classified telephone directory in the following cities where LESLIE factory-trained engineers are located.

Albany, N. Y.
Atlanta, Ga.
Baltimore, Md.
Beaumont, Tex.
Birmingham, Ala.
Boston, Mass.
Bridgeport, Conn.
Buffalo, N. Y.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Denver, Colo.
Detroit, Mich.
Galveston, Tex.
Greensboro, N. C.
Greenville, S. C.
Honolulu, Hawaii
Houston, Texas
Indianapolis, Ind.
Kansas City, Mo.
Kingsport, Tenn.
Los Angeles, Calif.
Louisville, Ky.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Mobile, Ala.
Monroe, La.
Montreal, Canada
New Orleans, La.
New York, N. Y.
Orlando, Fla.
Philadelphia, Pa.
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Ponca City, Okla.
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Richmond, Va.
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Salt Lake City, Utah
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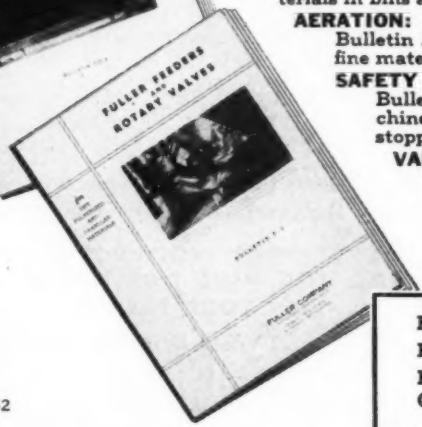
FLOATLESS LEVEL CONTROLS • PUMP GOVERNORS • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • AIR HORNS • STEAM WHISTLES
PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS



BULLETINS FOR YOU!

We think that many chief engineers, chemists, operating engineers, and superintendents in the chemical-process industries should be interested in equipment illustrated and described in these bulletins. We shall be glad to send any of them to you.

CONVEYING:
Bulletin FK-25, Fuller-Kinyon Systems for dry pulverized materials. Bulletin FH-1, F-H Airslide, for fine, dry materials. Bulletin A-15, Airveyor, for dry crushed and granular materials.

COOLING:
Bulletin CO-4, Fuller Inclined-Grate Cooler, for high-temperature granular and lumpy materials. Bulletin PMC-1, Dry Pulverized-Material Cooler.

COMPRESSED AIR:
Bulletin C-5, Fuller Rotary Compressors and Vacuum Pumps, for air and gases, pressures to 125-lb. gage.

FEEDING:
Bulletin F-3, Roll and Vane Type Feeders; Rotary Valves, for dry pulverized and granular materials.

LEVEL CONTROL:
Bulletin I-3, Material-Level Indicator, for dry pulverized and granular materials in bins and silos.

AERATION:
Bulletin AU-2, Aeration Units, for agitating, blending, and activating fine materials stored in bins and silos.

SAFETY SWITCH:
Bulletin MS-1, Fuller Motion Safety Switch, for protecting machines, equipment, and processes against damage resulting from stoppage or reduced speed.

VALVES:
Bulletin SV-1, Fuller Slurry Valves, for stopping or diverting of slurry conveyed through pipe lines.

FULLER COMPANY, CATASAUQUA, PA.
CHICAGO 3 — 120 S. LaSALLE ST.
SAN FRANCISCO 4 — 420 CHANCERY BLDG.

G-62

fuller

FULLER COMPANY, CATASAUQUA, PA.
Please send bulletins as checked:
FK-25 ☐ FH-1 ☐ A-15 ☐ CO-4 ☐ PMC-1 ☐
C-5 ☐ F-3 ☐ I-3 ☐ AU-2 ☐ MS-1 ☐ SV-1 ☐

NAME.....TITLE.....

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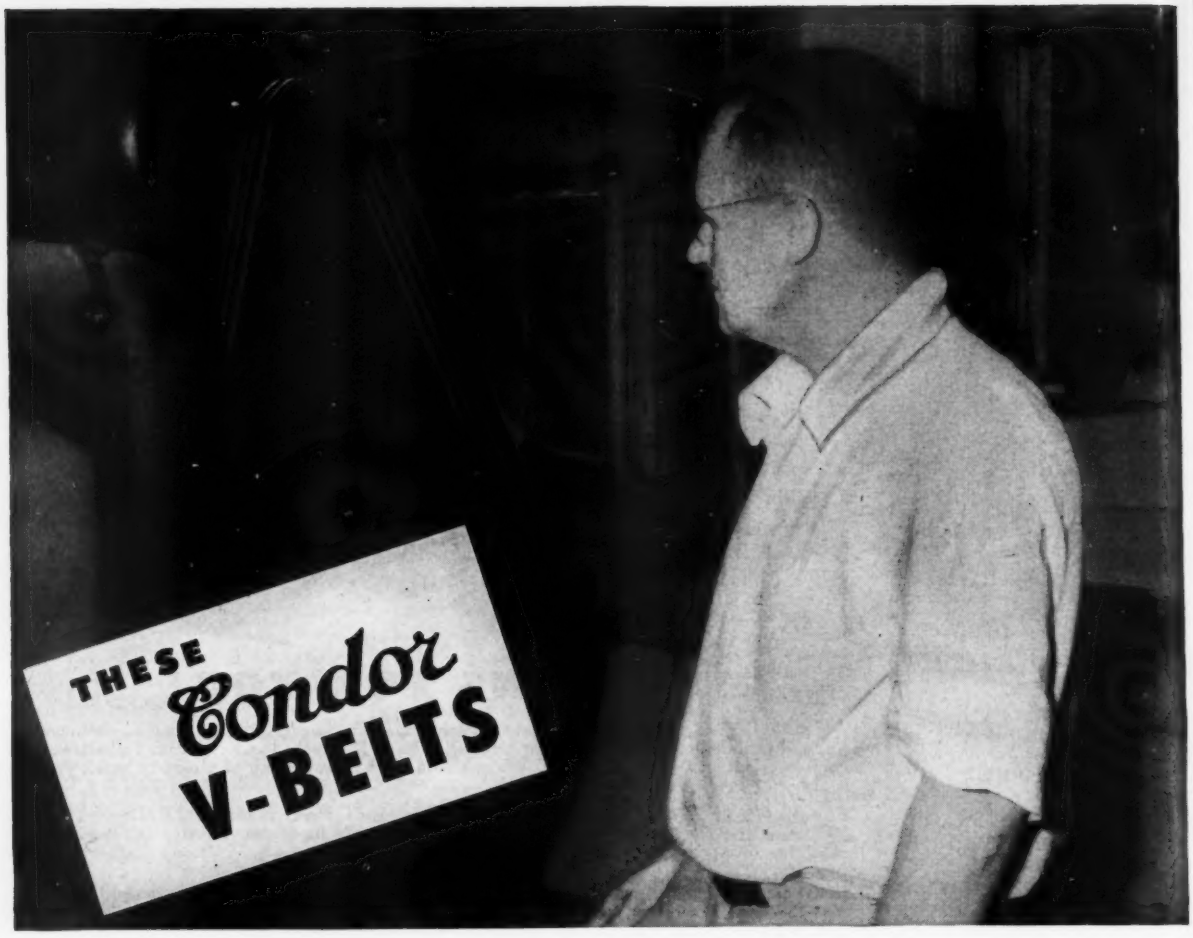
ADDRESS.....

CITY.....STATE.....



Ran 45,000 Hours in 12 Years

O. U. Thompson, Laundry Manager for the University Hospital at Augusta, Georgia has this to say in an unsolicited testimonial for Condor V-Belts:

"This belt (referring to one he sent with his letter) was in service on a 42" x 84" Troy Washer for a few weeks over 12 years, and was working nine hours a day for six days a week . . . and a good many Sundays. In round figures I would truthfully say this belt has run 45,000 hours with only two adjustments. These washers are always loaded to capacity every wash. I think this is outstanding service for V-Belts and I recommend them highly for light or heavy duty performance."

The installation on which these three Condor V-Belts served so many thousands of hours is shown above. You may have service records on Condor V-Belts that are equally impressive. Condor V-Belts have made power transmission records on many types of drives from multiples of 2 to 20 or more—on light duty, high speed drives—and on heavy, difficult drives.

NEW IMPROVED *Condor* WHIPCORD V-BELTS

New, super-strength cords of synthetic fibers and a new pressurized full-mold method of manufacture insure the *smoothest running V-Belts made.* They should do even better on the drive shown above.

For tough, rugged drives we offer the new brawny RAY-MAN V-Belts, which are non-spark, oil-proof and heat resistant.

Buy V-Belts through your Manhattan distributor and enjoy the savings so many other companies report.

DO YOU HAVE THIS FOLDER IN YOUR FILE?

This useful V-Belt Bulletin #6868C will be mailed on request.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

INDUSTRIAL POWER

May, 1950 Vol. 58, No. 5

1920 — INDUSTRY AND POWER — 1950

30th Anniversary Report of Engineering Highlights

EXECUTIVES AND ENGINEERS throughout the country received their first copy of INDUSTRY and POWER on May 1, 1920. Month-by-month during the intervening thirty years, its pages have consistently carried up-to-date and factual information on developments in equipment and practices of interest to plant engineers.

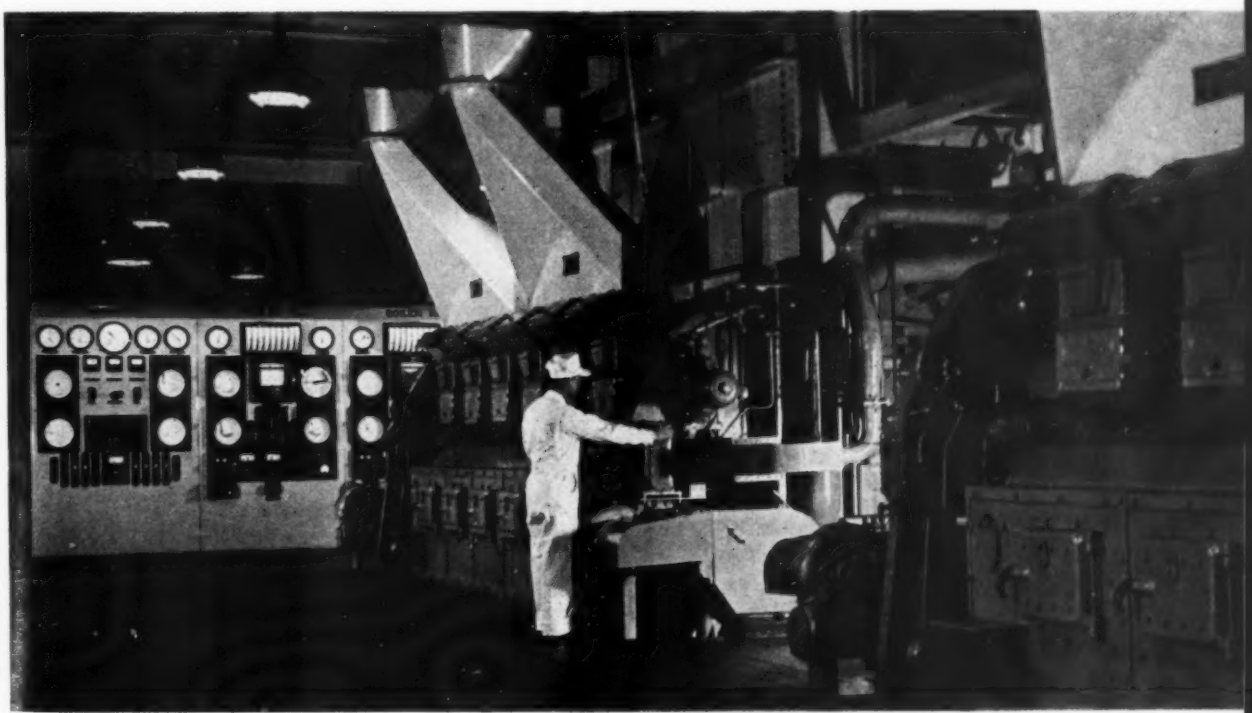
This month, on our Thirtieth Anniversary, we believe it profitable to review developments and in so doing obtain a better perspective of technical objectives that to some may seem beyond the realm of practicability.

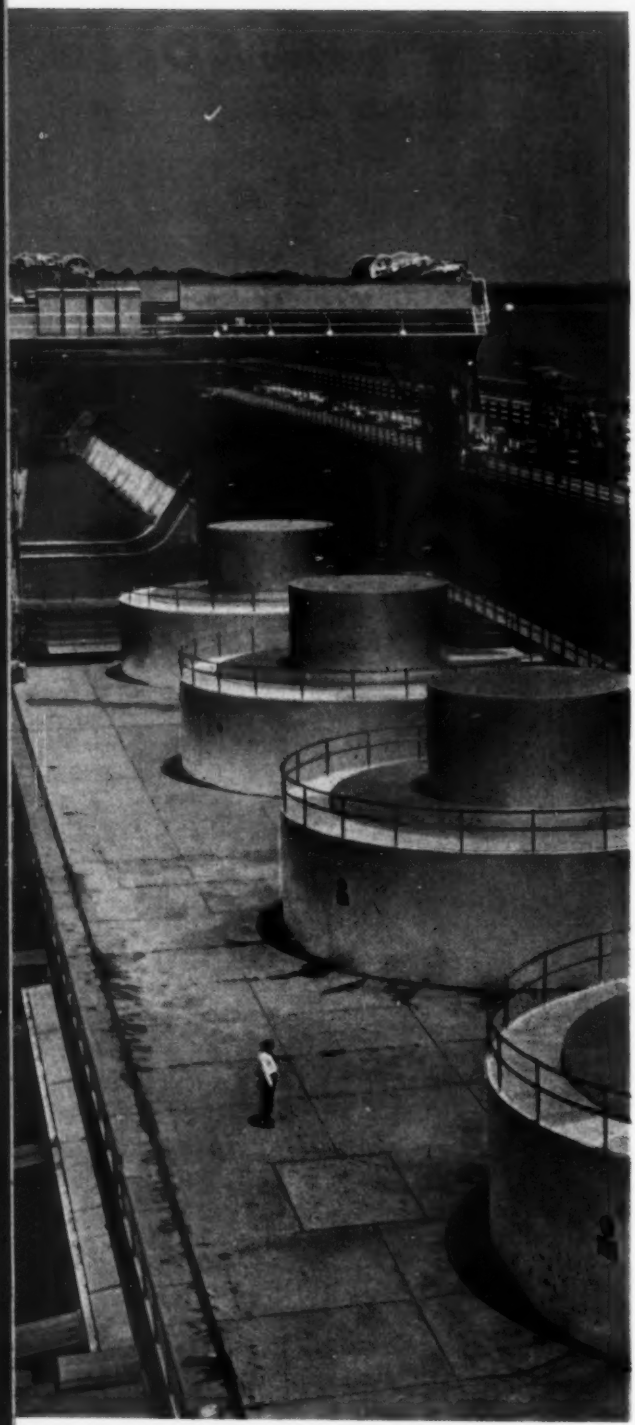
The same feeling existed when our nation was young, but men of vision and determination made their dreams come true in the form of machines and power to drive them. Power at the flip of a switch or the turn of a valve to turn out the countless things that made our country the great nation it is today. Thirty years ago power was in its infancy. Power plants were few and widely separated. In many sections they operated only at night to supply electricity for lighting.

But the dreamers were at work. They found more jobs to do, and put those generators to work twenty four hours a day. It wasn't too many years before the job was too big for one plant to handle, so they were tied together to help each other. Power systems grew and were interconnected until today the country is criss-crossed with a network of high-voltage lines tapping power sources equal to any assignment.

A lot has been accomplished in the past three decades. The infant *power* had a new generation of dreamers im-

High-pressure 150,000 lb per hr boilers at GM's Electro-Motive Div., LaGrange, Ill.





These generators at Wheeler Dam now contribute 129,000 kw to TVA system's installed capacity. Hydro horsepower in U. S. A. increased from 7.5 million in 1920 to over 27 million at the end of 1949. Over this period, capacity increase averaged about one million horsepower per year

proving it and searching for new ways to put it to work. We can show you only a small part of what they accomplished in the following pages, but it is enough to make the future look full of promise.

● **Hydraulic turbines,** although showing practically no increase in design efficiency since 1925, have grown in physical size and capacity from 38,000 hp in 1920 to 150,000-hp units in Grand Coulee. Yearly generation has jumped from 17.5 billion kwh to more than 86 billion in public and privately owned utility plants. Industrial installations accounted for another 5 billion in 1949.

Installed horsepower increased sharply from about 7.5 million in 1920 to over 27 million at the end of 1949. Not counting a slight lull around 1933, capacity increase averaged about one million horsepower a year.

Most hydroelectric power sites in this country have relatively low heads, consequently vertical hydro-generators far outnumber the horizontal type.

Noteworthy development during the past thirty years is the propeller and Kaplan turbines. Considerable research and testing on the latter type was carried out in the hydraulic laboratory of the Penna Water & Power Co, to design the units for a low-head plant of the Safe Harbor Water Power Corp (built in 1932) and several government plants built later. Major economic importance of the Kaplan and propeller turbines is that they decrease the total installation cost, making it feasable to develop low-head sites not previously practicable.

Early vertical hydro units used a ball bearing to carry the runner weight and hydraulic thrust, but the heavy duty caused numerous failures. A solution appeared in 1911 when Dr. Albert Kingsbury introduced a bearing that supported the rotating parts on shoes, which were pivoted on jack screws at the center of loading. In the same year, a bearing of this type replaced a roller bearing for test purposes in the Holtwood plant of Penna. Water & Power Co.

Originally designed for rotation in only one direction, the Kingsbury bearing has been modified during the past thirty years to operate in either direction with equalized support between the shoes to eliminate critical adjustment. Either the Kingsbury or a spring-supported rotating disc thrust is now standard for vertical hydro generators.

Generator design has advanced from the original Niagara Falls units, on which the rotating field was placed external to the stationary stator so it resembled a revolving umbrella, to the inside rotating field. The description "umbrella" still sticks, however, to units having a combination guide and thrust bearing below the rotor.

Four 73,684-kva generators scheduled for the McNary Dam on the Columbia River are the heaviest units ever built. Each one wieghs 2,400,000 lb and has a bearing load of 4,000,000 lb.

● **Steam turbines** in 1920 had found their place as a prime mover not only in central stations but also in industrial-plant service. Double-flow and compound units had arrived, and by 1930 cross-compound machines had grown to 165,000 kw in size. A tandem single-shaft machine of the same size went into service in 1935.

One factor of great importance contributing to an in-

crease in turbine size was the feedwater heating cycle, which came into use in 1922. It extracted part of the expanded steam from one of the turbine stages to heat the feedwater on its way to the boiler.

First turbine blades were drawn of brass and phosphor bronze, but in 1921 temperatures of 600°F were coming into use and these were replaced with manganese copper. The appearance of stainless steel led the way to a study of similar alloys, which resulted in low-carbon, 12% chrome-iron blading in 1923. It is still used with considerable success but, with higher temperatures being proposed, research is under way to improve this alloy, or find a superior one.

Blade-root design underwent considerable changes until the inverted T root was finally adopted. As blades got longer they had to be braced against each other. For many years, the blades were pierced a short distance from their outer end and a lashing wire was run through and silver soldered to each blade.

In 1935, shrouded-blade construction was adopted and proved successful except on very long blades. This practice, followed by welding the blade abutments together, is a common method of strengthening turbine blades today. Blade erosion shields of stellite were adopted in 1929 for wheels in the last stages where the moisture content is high.

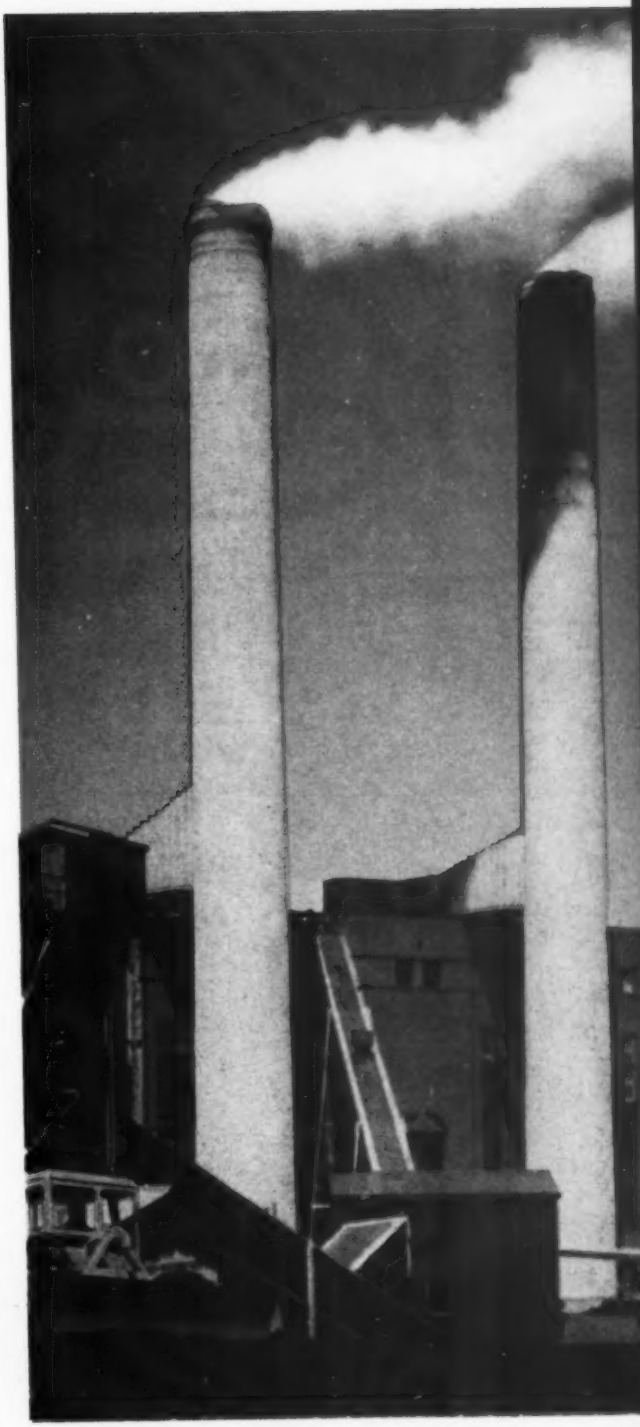
Pressures of 325 psi and temperatures of 650°F, in vogue at the beginning of 1920, have shown a fairly uniform increase over the years up to present-day values. Turbine speeds of both 1,800 and 3,600 rpm still remain popular with the ratings of 1,800-rpm, double-flow units increasing sharply to 165,000 kw by 1927 and then leveling off. Next notable event was hydrogen cooling in 1928. The double-flow, 3,600-rpm unit coming into the field around 1929, also rapidly increased in size. Single-flow units of both speeds had a more moderate capacity increase. Heat rate has dropped from about 13,500 to 8,000 Btu per kwh.

The reheat principle, introduced in recent years, appears to offer attractive gains—a single stage of reheat to the initial throttle temperature decreases heat consumption by slightly more than 4%. A similar gain obtained by advancing the steam temperature from 1050°F would call for a temperature in the neighborhood of 1250°F—a difficult and costly increase to make.

Reheat turbine development now in progress involves high-temperature, 3,600-rpm units retaining all the advantages of unidirectional flow in the high-pressure cylinder by utilizing an isothermal reheat diaphragm. An 80,000-kw, 1,800-rpm unit for 1,380-psig, 900°F steam and reheat to 900°F with vacuum at one-half inch mercury pressure was placed in operation, and another, for 1,450 psig, 950°F and reheat to 950°F is under construction.

Among noteworthy turbine-generator units installed in 1949 was a 150,000-kw, tandem-compound, double-flow, 1,800-rpm unit for the Fiske Station of Commonwealth Edison Co. It is built for maximum capacity of 165,000 kw, with steam conditions of 1,250 psig and 925°F, and is the largest unit so far put in service at 1,250 psi. The 1,800-rpm, 176,470-kva generator is hydrogen cooled and incorporates eight vertical coolers, four along each side of the generator. The one-piece stator, physically the largest so far constructed for hydrogen cooling, weighs 398,000 lb.

The first of two 100,000-kw, 1800-rpm, 1300-psig, 950°F turbine-generators went into service at the Trenton Channel Plant of Detroit Edison Co. They are tandem-compound, double-flow, condensing units with hydrogen-cooled generators of 125,000-kva capacity.



The Bryce E. Morrow plant near Kalamazoo, Mich., is one of the larger stations of the Consumers Power Company that supplies electric service to most of lower Michigan outside the Detroit area. Generating capacity was originally 120,000 kw but expansion raised it to 180,000

The first two of six identical 125,000-kw, cross-compound units for a utility system were installed for 2,000 psig and 1,050°F, with resuperheat to 1,000°F. They are expected to be the most efficient central-station units in the world.

A 150,000-kw, 3,600/1,800-rpm cross-compound turbine to operate with 1,800-psi, 1,050°F steam is being completed for the Ridgeland Station of the Commonwealth Edison Co. Another installation consisted of a 107,000-kw, 1250-psig, 1000°F machine to exhaust to one inch mercury.

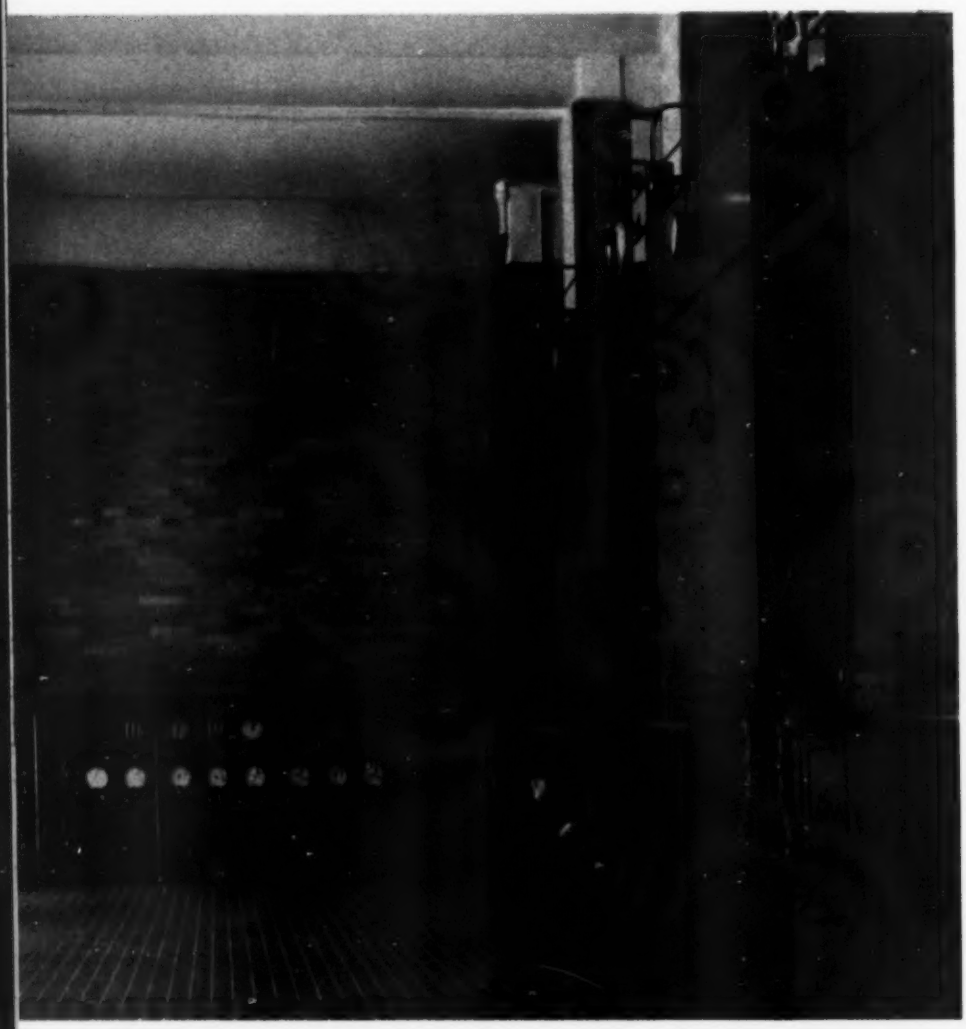
About four years ago standard designs were agreed upon for turbine-generator units of 1500, 20000, 30000, 40000 and 60000-kw capacity. They have been so successful and popular that a large percentage of machines ordered within the standard range have been units of this type. In the light of recent developments, standardization of 90,000 and 135,000-kw units may be considered.

Turbines are now operating at pressures as high as 2,300 psi, temperatures as high as 1,050°F and capacities of over 200,000 kw. Engineers now visualize units as large as 300,000 kw that may operate at 3,200 psi and temperatures of 1,200 or 1,300°F.

A turbine built for 3,200 psi and 1,200°F should produce about 8% more kwh per ton of coal than a 2000-psi, 1050°F unit if both employed reheat. This would give a turbine having a thermal efficiency of about 40%, compared to today's anticipated best of 37%. In a machine of this kind, forged parts would be out of the question, because they would not stand the temperature. This leaves the design engineer with considerable development work for the years ahead.

● **Feedwater treatment** in the early days of power development consisted mostly of cure-all mixtures and home remedies. Some did a good job while others benefited no one except the producer. As with progress in other lines, feedwater quacks were forced out as the cloak of respectability settled down over the industry. Engineers and chemists together have developed the business into an exact science, which seeks information to extend boiler design limits as well as solve immediate problems.

Developments during the past thirty years have given us a great variety of natural and synthetic zeolites, which produce either acidic or alkaline water, or a blend of the two to meet our needs. When the problem of silica appeared, along came the solution with hydrofluoric acid and ion exchangers. Further progress brought synthetic resins, a direct silica absorption unit and complete demineralization.



● **Diesel power plants** under some conditions are the most economical producers of electricity for industrial establishments, waterworks, municipalities and other consumers. Installed capacity in generating stations over 1000 kw increased from 520 in 1910 to 180,000 in 1930, to 320,000 in 1940, and an estimated 600,000 kw in 1949. The major trend today appears to be toward widespread application of

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Striking color scheme is a feature of power plant at Father Flanagan's Boys' Home, Boys' Town, Neb., as illustrated by this view of the boiler room. Speaking of boilers, operating pressure has advanced from about 325 psi in 1920 to 2600 psi today. During the same period temperatures have risen from a little over 600°F to about 1050°F

During the same period, other investigators were improving the cold-and hot-process softener through various stages, which included sodium aluminate for better floc formation, silica removal with magnesium hydroxide and ferric sulphate, and final softening with hot phosphate. Phosphate after deposits in heaters and economizers was licked by adding acid or organic inhibitors to the feed line. Trouble with chemical feeders led some plant engineers to switch from lime to caustic soda in these softeners.

After treatment of cold lime-soda effluent by zeolite was followed by resin exchangers, which handle water from a hot-process softener.

Internal treatment has progressed from graphite and kerosene to a scientific basis with colloids, tannins, sodium aluminate, phosphate, caustic soda, sodium sulphite (for oxygen removal) potassium salts, etc. Caustic embrittlement has been licked structurally by welding the boiler joints, and held in check with sodium nitrate as an inhibitor when free caustic is present.

When feedwater treatment is not adequate, or its control fails and scale forms on boiler surfaces, we now have acid cleaning to remove the coating more thoroughly and quickly than manpower.

Corrosion is held in check by maintaining the boiler water alkaline, and using scavenging agents such as sodium sulphite, tannins and lignins to neutralize residual oxygen. Return-line corrosion can now be held in check with amines and ammonium salts.

Grooving, and gradual loss of metal, resulting from accelerated reaction between overheated metal and water or steam, and iron oxide scale are problems confronting plant engineers and water-treatment experts today.

On the mechanical side, the last three decades have given us evaporators for makeup, deaerators that remove oxygen to such a point that it requires precise laboratory equipment to test for residual, and feedwater regulators that keep boiler water level where it belongs regardless of load.

● **Steam generators** of today can be selected in almost any size and shape to suit the engineer's fancy. Operating pressure advanced in the U S, from about 325 in 1920 to 2600 psi, while European practice reached the critical pressure of water.

Temperature, likewise, has risen from a little over 600°F to 1050°F. Largest-capacity unit being built today is the 1,300,000 lb per hr steam generator for Hudson Avenue Station of Consolidated Edison Co. Although there are only

smaller sizes. This has been made possible only by relatively recent engineering developments, standardization, and production economies. Present day high operating costs of some generating equipment has added to the existing incentives for the development of new fields of application for the diesel. This is to be the subject of a comprehensive report to be published soon in INDUSTRY and POWER

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Double-suction centrifugal pump is shown here on the new 300 hp Allis-Chalmers test stand. The latest in the pump field is a single-suction double-case boiler feed pump designed with seven stages for pressures to 2500 psi. The development was based on exhaustive tests of various volutes, return passages and impellers

a few 1,000,000 lb per hr units in operation, 900,000 lb per hr is quite common.

About 1930, a sharp rise in design pressure took place (from 600 to 1200 psi), which was the start of superimposing (topping) a high-pressure boiler and turbine on an existing low-pressure plant. The practice flourished for about ten years, but has tapered off until today a new topping installation is rare.

Operation at high pressures and temperatures demanded changes in methods of manufacture as well as erection. Metals had to withstand furnace-gas erosion and rupture, and joints had to be welded to prevent caustic embrittlement.

Water still holds first place as the generating fluid, although mercury has shown good results. It was first used in 1922, and installations were made in Hartford, Conn., Schenectady, N. Y., Kearny, N. J., and Lynn, Mass. Principle application of the mercury cycle appears to be that of topping high-pressure plants.

Forced-circulation units have been built and give a good account of themselves, but they haven't been widely accepted. This is equally true of superheated water units in comparison to steam. Waterwall design has reached such a state of perfection that, for water capacity, the drum no longer is considered a water reservoir, because its main purpose is to act as a housing for separators and scrubbers that dry the steam before it enters the header.

Control of superheat is critical over the load range, and many designs of superheaters have entered the field. This is also true of attemperator and desuperheating control. Overheated waterwall tubes in certain furnace areas brought about the use of metal and refractory shielding. Demands for higher efficiency meant better firing, so various mechanisms appeared on the scene—simple damper operators, which have finally matured into intricate control systems that keep furnace conditions right on the line.

In the last thirty years several new stokers have entered the field, as has the cyclone furnace. The latter is able to burn coal having a high-ash content and low fusing temperature. Last, but not least, is the packaged boiler, a unit complete with all firing equipment attached ready to pipe up.

Now that the possibility of atomic energy is on the horizon, what the future holds in the way of steam-generating equipment is anyone's guess. Using it as a source of heat for steam production does not appear to offer many advantages, because fuel cost is the smallest item in power-plant expenses. But don't bet on this; our scientists may fool you.

● **Pulverized coal** used by electric power stations in 1925 amounted only about five million tons. Today, more than half of the new utility steam plants are designed to burn it. Improvements came in pulverizing equipment and separators to remove flyash from the flue gas. While early plants used a central pulverizing system, the trend today is an individual unit for each boiler. Biggest problem now is to find a way to clean flyash from the combustion gas so gas turbines can be fired with pulverized fuel.

Warnings were sounded about 1930 that our oil supply would be exhausted in twenty years, and just recently the cry was again voiced. Some day it may be true, but indica-

Dust collectors of this type maintain peak cleanliness in America's industrial plants. This unit is located over production line in Oldsmobile's engine factory

tions at present contradict it. The Bureau of Mines pilot-plant tests show we can extract oil from shale at competitive prices with petroleum products ($1.50 to 1.80 a bbl with a capital investment of $1,750 per bbl per day). The shale oil can be refined to gasoline, jet fuel, diesel oil and fuel oil. Shale deposists available will supply more than twice the amount of oil produced (39 billion bbl) in the U S from wells to date.

Getting oil from coal is just one step away. The Bureau of Mines is busy developing modifications of coal hydrogenation and gas synthesis processes that convert coal to gasoline and oil, which show a production of 80 to 100 gal of liquid products per ton of coal. Price differential between these and petroleum distillates is not great. A chemical corporation is now contemplating a ten-million-dollar plant to produce chemicals primarily, with gasoline and oil as byproducts.

● **Power stations** had begun in 1920 to interconnect with each other. They were small, and voltages low, because electricity was used mostly for lighting. But conditions soon changed. Transmission lines spread out to serve heavy industrial consumers and act as interconnections between widely separated systems.

As interconnections and stations grew, voltages rose and the need for heavy power transformers and switchgear was apparent. Another problem arising out of the "so-called" super power systems was the matter of stability—interconnecting tie lines did not have capacity enough to hold the systems together. It was about this time that C. L. Fortescue invented symmetrical components—a branch of mathematics essential to the analysis of complex electrical systems. This method of calculation held the solution to interconnection instability.

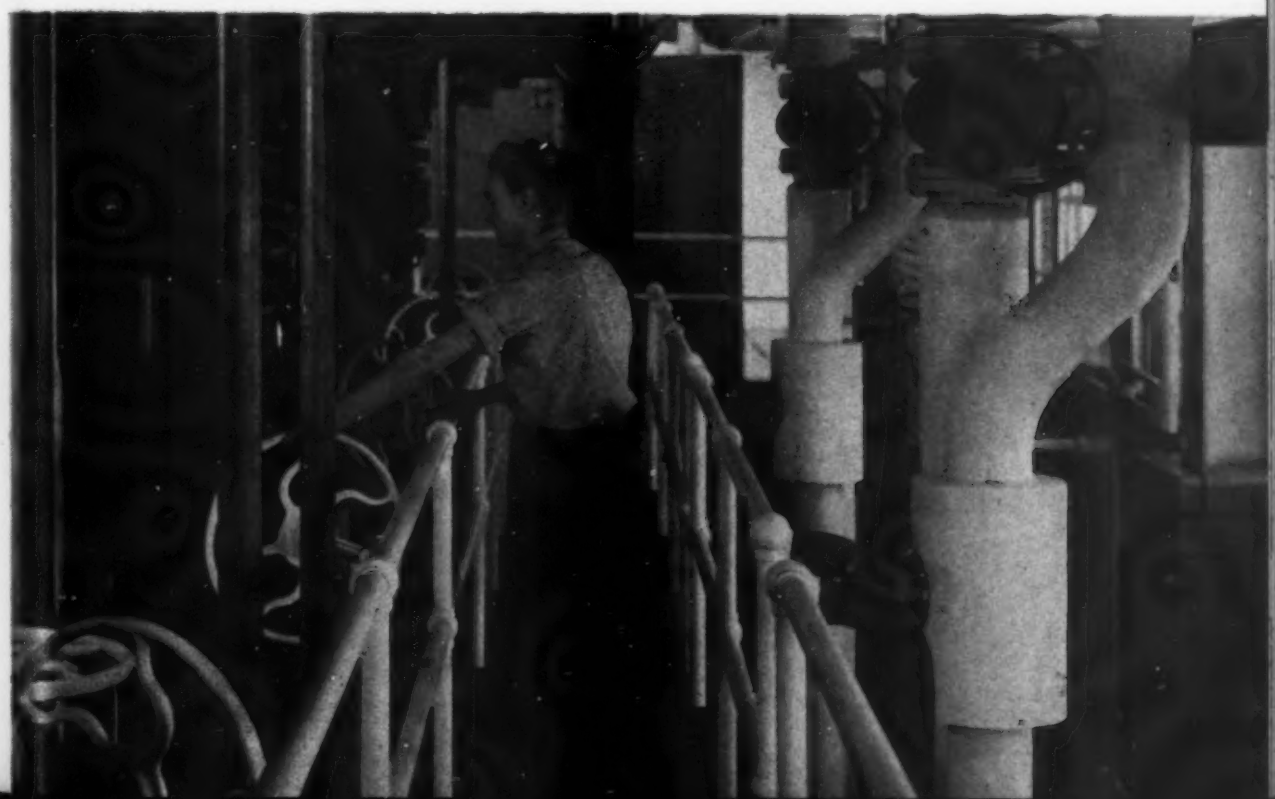
Engineers were then able to select combinations of generators, transformers, transmission lines and switchgear that made interconnections stable. Similarly, the electrical system insulation had to be coordinated to avoid weak links.

In 1920, manufacturers had switching devices, but did not know exactly what they could do in the way of interrupting faults. A real advance was made when Consolidated Gas, Electric Light & Power Co of Baltimore made short-circuit tests of 600,000 kva on its 13.2-kv system. Other important tests were made on the systems of New York Edison Co and Alabama Power Co. From there it was a short step to improved high-interrupting-capacity, high-voltage circuit breakers, metal switchgear and transformers to match. Now we have high-speed circuit breakers that will trip a fault and reclose a circuit before the load is lost.

A circuit breaker built in 1949 has an interrupting capacity of 10 million kva, a jump in capacity of 6.5 million over the previous highest capacity unit. Transmission voltages increased to 287,000 when the Hoover Dam lines were put in service, and now experiments are being conducted on a 400,000-volt test line by the American Gas & Electric Service Corp.

At the beginning of 1920 transformers were being built with silicon-iron cores, but improved methods of alloy manufacture now permit them to carry more flux with the same

Valve walkway at Hope Natural Gas power station in Hastings, W. Va., illustrates its ivory-red color scheme. Power is generated by three Elliott 500 kw turbo-sets



amount of magnetizing force. Coil insulation, as affected by lightning surges and corona also came in for considerable attention. The insulating oil has survived many attempts to find a superior substitute for its outstanding weakness—inflammability. With the exception of air, these substitutes have not found much favor because they also have drawbacks. The dry-type transformer (air insulated) with fireproof coil insulation are built for 15 kv in moderate capacities.

Lightning was one of the worst enemies of transmission lines and equipment. At first, engineers assumed they would have to put up with it, but the toll in insulators, lines, transformers, generators etc. was so great lightning damage could no longer be tolerated.

First approach to the problem was installation of lightning rods, next came overhead ground wires, but they were mechanically weak and caused considerable trouble so they were temporarily abandoned. Arresters then came into the picture and passed through many phases of development.

Today we recognize the value of arresters, overhead ground wires and low-resistance tower grounds as protection against lightning. The first practical lightning-proof 220-kv line, owned by the Penna Water & Power Co, was erected in 1931 with overhead ground wires, low tower-footing resistance, underground counterpoise and arresters at each end. Although the line does not have a perfect lightning-proof record, performance has been good enough to permit saying it is practically outage-proof against anything except the most extremely severe direct strokes.

● **Gas turbine** development, newcomer to the power field, has been progressing rapidly since about 1935. Up to within the past few years they found widest application in the Houdry process of oil refining, where units with a total capacity of over 190,000 hp are installed.

Experiments and tests are proceeding rapidly on units for locomotive and power-plant work. A 2,000-hp, 1350°F oil-fired unit is now on test driving a centrifugal compressor on a natural-gas line; a 3,500-kw, gas-fired turbine generator was just recently installed in a central station; a 4,500-hp unit has been in successful operation as a railroad locomotive since late 1948, and others are on order for central station and industrial plant use. Possible sizes range up to 5,000 or 10,000 kw.

The first full-scale, coal-burning gas turbine was placed in operation in 1946 by the Locomotive Development Committee of Bituminous Coal Research, Inc. so operating tests could be made on coal preparation, handling, combustion and ash separation equipment sized to be used in a locomotive. A 4,200-hp power plant will soon be placed in operation on pulverized coal *(Industry and Power, June, 1950)*.

Important work to be completed on the gas turbine is to develop alloys that will withstand temperatures of 1,500°F for long periods under stress and find a completely reliable method of separating flyash in coal-fired units.

The gas turbine now stands about where the steam turbine stood at the beginning of the century; the next 50 years holds tantalizing promises for engineers and scientists.

These 2500 kw units, one condensing extraction and the other back-pressure, are at the Charles P. Pfizer plant, Groton, Conn.

PROPER COAL USAGE CONFORMS TO AIR POLLUTION ORDINANCES

Having briefed the history and development of air pollution regulations in the first installment of this article, the author now explains how such pollution can be reduced by proper firing and knowing the operating characteristics of firing equipment

WILLIAM S. MAJOR, Development Engineer
Bituminous Coal Research, Inc.

EVEN though fly ash and smoke are only a small part of the entire cause of air pollution, the nuisance can be reduced to a great extent by proper firing methods of furnaces. As stated in the preceding article, there are four basic factors conductive to smoke formation, and because the factors are so important the following resume is given: First, the fire must have sufficient overfire air; second, the fuel bed must have a minimum of agitation; third, the volotile matter must be distilled slowly; and fourth, the furnace must be large enough for the capacity and not too cold. Careful adherence to all four factors is necessary to reduce pollution, but a study of the firing method and characteristics of the furnace are also essential.

The operating characteristics of underfeed stokers, chain and travelinggrates were discussed in the past issue, which will now be followed with the principle firing characteristics of spreader stokers.

Spreader stokers have the ability to burn coals of widely diversified burning characteristics, are easy to operate, respond quickly to increasing or decreasing load changes, and have low maintenance even at high burning rates. Operation is with a thin non-agitated bed of burning fuel which rests on a layer of ashes about two to four in. deep. Fuel, mechanically or pneumatically fed to the furnace, is subjected to the full furnace temperature before it reaches the grate. As a result, there is a quick partial distillation of volatile matter and tarry hydrocarbons which reduce the tendency of larger sizes of fuel that drop to the grate to cake together into solid masses.

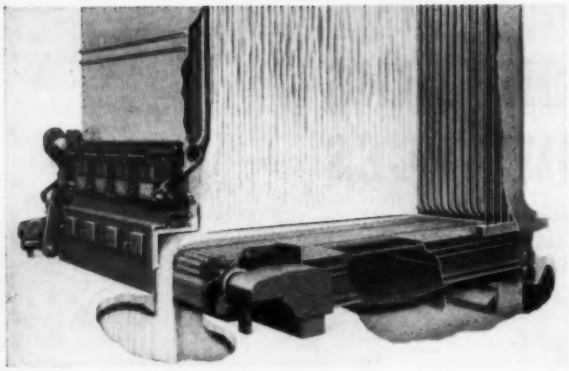
Because of the method of introducing fuel to the furnace, dust emission is frequently not as favorable as other types of stokers. It must be recognized and reduced by proper dust collectors. In some cases, with relatively low burning rates and certain coal sizes satisfactorily low dust emission is realized with no collector or with possibly only a low-resistance type of unit. However, it is frequently deemed advisable to install a high resistance type of collector to insure greater fuel flexibility without sacrificing satisfactorily low dust emissions.

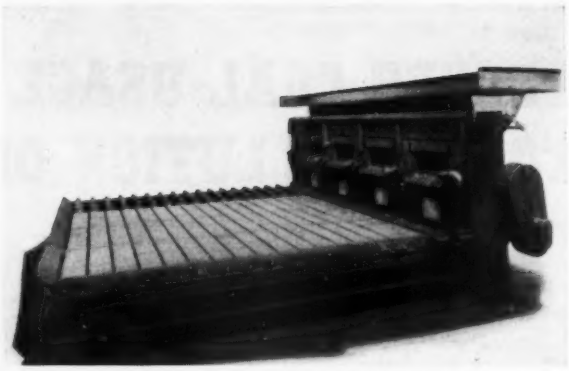
Current designs of spreader stoker fired furnaces generally operate at less than 30,000 Btu per cu ft per hour and many are provided with partial or complete water cooling. They have sufficient grate area to maintain burning rates within reasonable limits of Table 2, which is the following page.

The maximum burning rates for traveling grates are generally employed only with generators of over 100,000 lb of steam per hour with large water-cooled furnaces. Such units provide long gas travel between grate and boiler entrance. Steam jets and/or motor-driven fans capable of delivering 5 to 15% overfire air are installed in practically all newer installations to provide needed furnace turbulence for improving combustion, controlling smoke, and reducing cinder carryover.

Table 3 shows the results of dust loading tests conducted on modern, well-designed spreader stoker fired boilers. Need of a dust collector is indicated to clean boiler exit gases before discharge to the atmosphere if stringent ordinances are to be met. Low dust in the gases leaving the collector and discharged to the atmosphere, as compared the ASME code of 0.25 grains, are plotted on one of the accompanying illustrations.

Although the trend is definitely toward mechanical firing, many smaller boilers are still hand-fired and skill of the operator is the all important factor in burning fuel with minimum smoke and cinder carryover. There are three generally recognized and accepted methods of good firing: (1) coking, (2) alternate or strip, and (3) spreading. Coking means piping fresh coal in the front part of the furnace to permit slow distillation of volatiles. The distilled gases, in passing over the hot portion of the fuel bed, rise in temperature and mix with air introduced over the fire for complete burning.





Spreader stokers have the ability to burn coal of widely diversified burning characteristics. They are easy to operate, they respond quickly to increasing or decreasing load changes, and they have low maintenance even at high burning rates. The burning fuel rests upon a layer of ashes about two to four in. deep, which results in a thin non-agitated bed

Coke is pushed to the rear before green coal is added at the front of the furnace area.

With alternate firing, coal is fed first to one side of the furnace. Volatiles that are released, mix with air passing through the live side of the grate. The next firing is on the adjacent side which is fairly well burned down. This system differs from the "coking" principle in that the coke is never moved back.

Spread firing is a system of throwing coal over the entire grate as uniformly as possible. Success depends upon frequent light firing, keeping the fuel bed holes covered, and preventing excessive thickness of the bed at any section.

Either of these three firing methods can be improved by an over-fire jet, which provides auxiliary turbulence and overfire air to aid burning of the volatiles. Many plants utilize steam air or blower jets for effective control of smoke for a few minutes following each firing of green coal or when needed.

Problems With Old Plants

Many existing plants have limited grate area and questionable furnace construction, and they are inherently more difficult to operate in compliance with ordinances than newer plants. Although little can be done to reduce objectional discharge from some of the installations, others can be substantially improved. For instance, overfire jets provide necessary turbulence to offset furnace volume limitations and reduce smoke. Technical reports are available as guides that are being increasingly adopted for design, construction, and applications of jets for different types of furnaces and firing systems.

Results of tests with and without overfire jets in operation on an old handfired boiler are shown in the

TABLE 2—COAL BURNING RATES FOR SPREADER STOKERS

Type of grate	Btu in fuel per sq ft of grate area per hr	
	Max. continuous	Peak (2 hr)
Stationary	400,000	450,000
Dumping	475,000	525,000
Traveling	575,000 to 700,000	650,000 to 750,000

TABLE 3—TEST DATA OF DUST LOADING FROM SPREADER STOKERS

Plant	Burning rate, Btu per sq ft per hr	Grains per cu ft of gas at 12% CO_2 = 500° F	
		Leaving boiler	Leaving dust collector
D	730,000	2.16	0.14
	745,000	1.23	0.12
	750,000	1.19	0.11
E	453,000	0.90	0.066
	461,000	0.95	0.067
	476,000	1.02	0.065
F	173,000	0.36	0.045
	271,000	0.37	0.040
	405,000	0.54	0.066
	493,000	0.74	0.117
	499,000	0.77	0.124
G	349,000	0.25	0.124
H	459,000	0.38	(No dust collector)
J	126,000	0.32	0.200
	226,000	0.15	0.060
	264,000	0.21	0.046
	336,000	0.48	0.080
	403,000	0.54	0.110

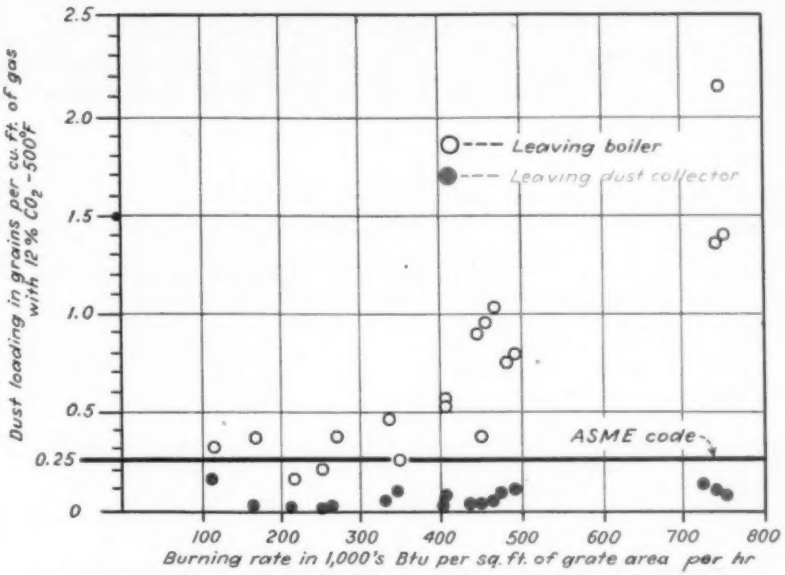
TABLE 4—RECOMMENDED STANDARD COAL SIZING SPECIFICATIONS

Spreader type stokers:	
Kind of fuel	***Sizing specifications***
Eastern bituminous (friable)	1¼ or 1½ in. nut and slack; not more than 50% slack through ¼ in. round mesh
Eastern bituminous (non-friable) and midwest bituminous	¾ in. nut and slack; not more than 50% slack through ¼ in. round mesh
Underfeed stokers, single or multiple retort:	
Kind of fuel	***Sizing specifications***
Eastern bituminous (friable)	2 in. nut and slack; not more than 50% slack through ¼ in. round mesh
Eastern bituminous (non-friable) and midwest bituminous	1 to 1¼ in. nut and slack; not more than 50% slack through ¾ in. round mesh
Traveling grate and chain grate stokers:	
Kind of fuel	***Sizing specifications***
Midwest bituminous and lignite	1 in. nut and slack; not more than 50% slack through ¼ in. round mesh (coal uniformly tempered up to 15% total moisture)

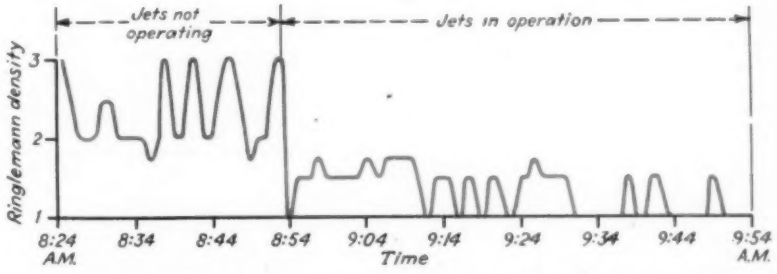
graph. When the jets were not operating, several periods when the smoke reached a Ringlemann No. 3 density are noted. With the jets operating, however, the maximum density at any period was less than Ringlemann No. 2 and the average smoke density was only slightly above a No. 1. In other cases, with more favorable furnace configuration, jets are showing performance of average smoke densities below a Ringlemann No. 1.

If the problem of an older installation is primarily excessive cinder or fly ash, cinder traps or dust collectors can be installed. Sometimes only a simple trap will suffice when the total emission is low but the particles are large. These traps depend upon a combination of direction change and lowered velocity to remove coarse material from the gas stream. As the quantity of dust and percentage of fines in the gases increases, a low resistance collector and, in some cases, even high resistance units are required.

When grate area is so small that high burning rate is the basic cause of smoke and high dust emission, a study of the possible addition of grate area and furnace modifications is necessary. At the same time, incorporating a continuous ash discharge mechanism on some stokers will eliminate fuel bed disturbance, higher smoke density, and carry-



Data plotted from test results of dust loading as indicated in Table 3. Gases leaving the dust collector were under ASME code specifications



Test results with and without overfire jets. Jets off, density reaches a Ringleman of No. 3. Jets operating, density averaged between 1 and 2

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4. "Technical Report VII, Application of Overfire Jets to Prevent Smoke from Stationary Plants", by R. B. Engdahl and W. S. Mahor, Bituminous Coal Research, Inc.
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over that accompanies grate cleaning.

Fuel characteristics most favorable in different types of stokers have already been discussed. But, an equally important factor is a continuous, uniform feed of the proper size of coal to all hoppers of the stoker. This feed characteristic is essential to promote fuel bed and furnace conditions for maximum combustion efficiency, low smoke density and dust. Although setting rigid standards for all applicable cases is impractical, recommended standard coal sizing specifications, available as a guide, have been prepared by the American Boiler and Affiliated Industries. These specifications (Table 4) represent the experience of leading stoker manufacturers.

Minimum smoke and fly ash require adjustment of fuel and air-delivery to all sections of the furnace in regard to amount, ratio, and furnace draft regulation. Skilled attentive operators can do this job quite well for a steady boiler output, particularly for firing systems that operate with a relatively thick fuel bed. However, under fluctuating steam demands manual regulation of coal and air supply for maximum efficiency becomes increasingly difficult. The problem is even more difficult when attempted on a firing system with a thin fuel bed and suspension burning. For instance, a spreader stoker has a thin fuel bed, small reserve of energy in the furnace, and a sensitivity to variation in feeding rates. Automatic control for such a furnace is the only practical means of operation to assure best stack conditions.

Anti-smoke ordinances are here to stay and plant engineers have an opportunity to supply the answers to local problems, before they find themselves confronted with more regulations and fees applying to ordinary furnace repairs. Smoking stacks are difficult to alibi, so the thing to do is find and elminate the cause. High-heat-value coal is fast disappearing and the only answer is to increase the furnace combustion space accordingly.

For the same furnace heat release, more of the low-heat-value coal must be burned. This means more grate area or deeper fuel bed and more combustion space. With correct furnace, a stack alarm warns of intermittent trouble.

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TYPICAL CALCULATIONS FOR INDUSTRIAL PO

TYLER G. HICKS, Hicks Associates

WHEN CONSIDERING construction of a new power plant or alteration of an existing one, certain general premises may safely be accepted. These premises, based on optimum efficiency and economy in plants supplying steam for process, heating and electrical loads, were discussed by the author in a preceding article: "Right Cycle Selection is Key to Plant Efficiency — INDUSTRY AND POWER, April, 1950, page 84. In the following paragraphs he takes a manufacturing plant and calculates its load requirements and annual operating costs, using four typical power plant cycles.

Power Supply Alternatives

General features of an industrial power plant cycle can usually be determined by a study of process load demands. Specific determination of relative fuel costs, plant efficiency, equipment costs, and annual operating costs cannot be accurately made by any rule of thumb. Calculations which take into consideration all forseeable factors are absolutely necessary if plant costs are to be a minimum. To illustrate the general nature of these calculations, the author has set up a typical planning problem. Although it is impossible to include in a general problem all factors entering into a specific one, all major factors which experience has shown are likely to occur have been included.

Any industrial enterprise which requires both steam and electricity in the manufacturing process can ordinarily be served in one of four different ways: (1) generate process steam in privately owned boilers and purchase current from the local utility; (2) generate process steam in privately owned boilers and use diesel or gas engines for generator drive; (3) generate steam and current in a privately owned low-pressure plant; or (4) use an arrangement similar to (3) except that steam is generated at high pressure. These are the obvious alternatives and should be investigated first. Calculations and studies may show that none of these are suitable or that modifications are necessary. Such cases will be discussed later.

Plant Requirements

A manufacturing plant requires a maximum of 1,000 kw at an 80% load factor. Drying and distillation operations will consume 16.5 million Btu per

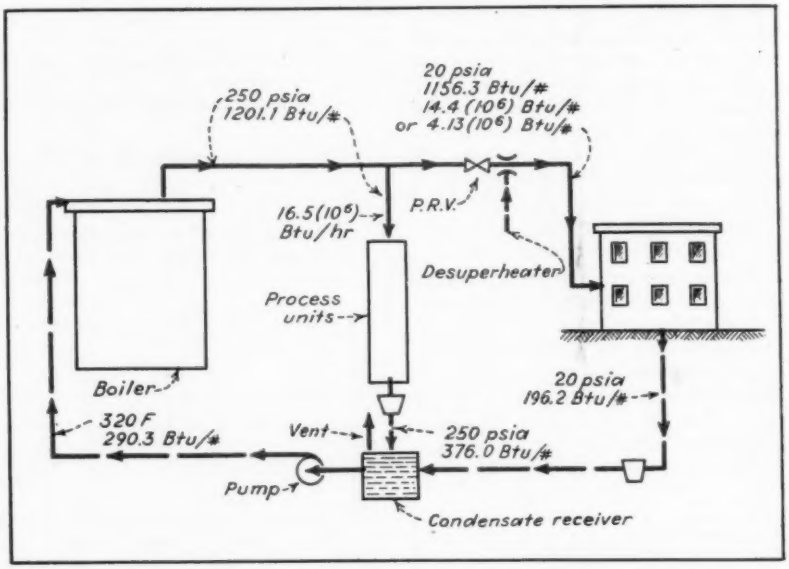


Fig. 1—Under Scheme A, the processing and heating steam is supplied by a single boiler, and all electrical energy is purchased from the local utility. All condensate is returned to the boiler

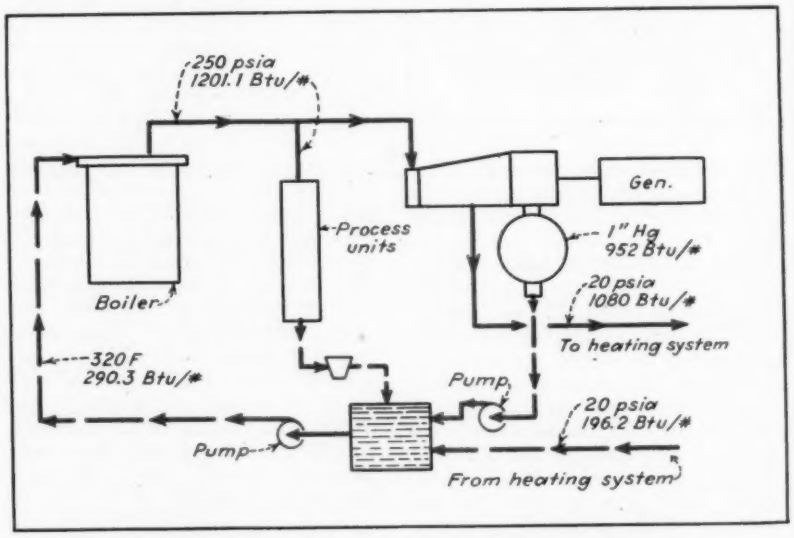


Fig. 3—In the arrangement for Scheme C, the process steam is supplied from high-pressure main and heating steam from extraction opening on the turbine. Turbo-generator supplies electrical power

AL POWER PLANT CYCLES

What is the most economical method of supplying steam for power, heating, and processing loads in a manufacturing plant? Selecting a typical plant, the author offers four answers to this question

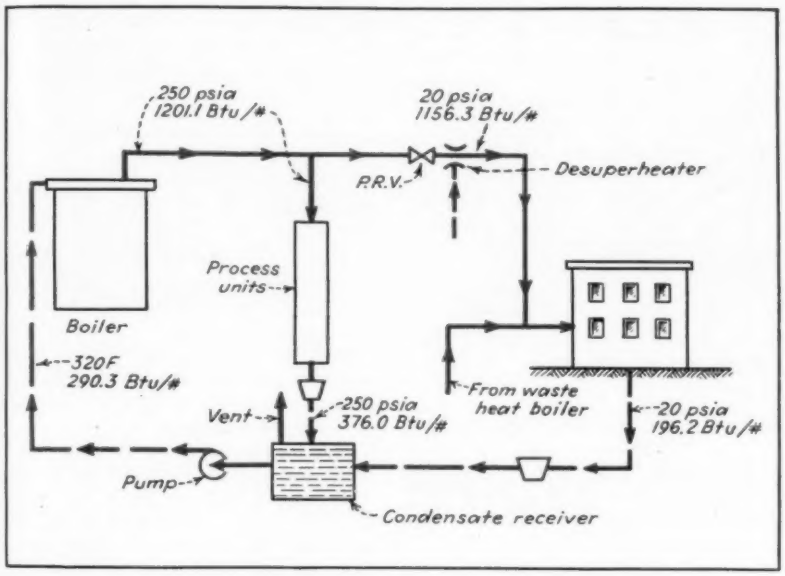


Fig. 2—In Scheme B, process and heating steam is supplied from the boiler shown; in addition, a portion of heating steam comes from a waste-heat boiler. Current is supplied by 500 kw diesel set

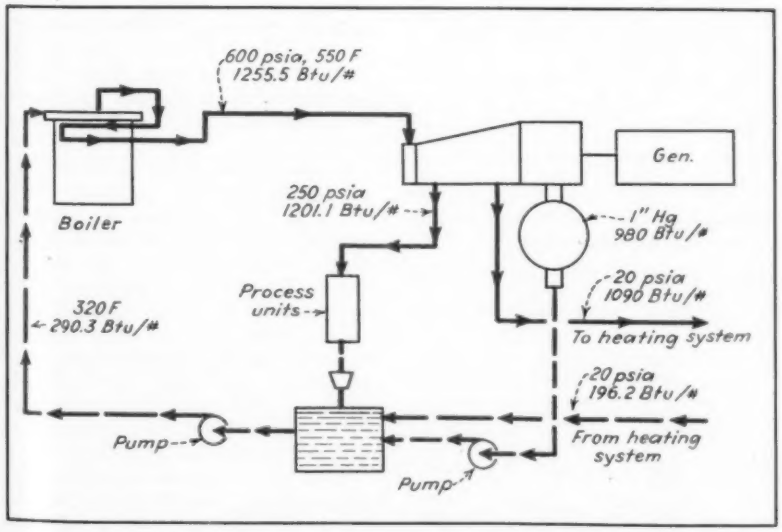


Fig. 4—For Scheme D, a double extraction turbine operating at high throttle pressure and temperature supplies steam for process and heating, and drives a generator to supply electrical energy

hr at a temperature of 400° F; average building heating will require 4.13 million Btu per hr. Maximum steam requirements for building heating are estimated to be 14.4 million Btu per hr. The most economical method of supplying heat and electricity is desired. Minor interruptions in power and steam supply can be tolerated. Four possible schemes satisfying these requirements are presented in the following paragraphs:

Scheme A—Fig. 1 shows the system layout. The required process temperature of 400° F can be obtained with dry saturated steam at 250 psia. Using this pressure, process steam load is

$$\frac{16{,}500{,}000}{1201.1\text{-}376} = 20{,}000 \text{ lb/hr}$$

of steam, the denominator of this expression being the heat given up by condensation of one pound of steam at 250 psia. Using the same reasoning, average heating load with pressure-temperature reduction to 20 psia is

$$\frac{4{,}130{,}000}{1156.3\text{-}196.2} = 4{,}300 \text{ lb/hr}$$

Maximum heating load is

$$\frac{14{,}400{,}000}{1156.3\text{-}196.2} = 15{,}000 \text{ lb/hr}$$

Therefore, total maximum steam requirements are

$$20{,}000 + 15{,}000 = 35{,}000 \text{ lb/hr}$$

This maximum demand may occur during the heating season, according to weather conditions. For summer operation, only the process steam demand, 20,000 lb per hr, will exist.

Assuming that coal with a heating value of 13,000 Btu per lb is the cheapest fuel available, that boiler efficiency is 65%, and feedwater temperature is 320° F, average fuel requirements during heating season are

$$\frac{(1201.1\text{-}290.3)(24{,}300)}{0.65(13{,}000)} = 2{,}620 \text{ lb/hr}$$

For an 8 month heating season, 240 days at a 16 hr heating load, average fuel consumption is

$$\frac{2620(240)(16)}{2000} = 5{,}030 \text{ ton}$$

During the summer, fuel consumption

is solely for process steam. With the same assumptions as previously made, hourly consumption is

$$\frac{(1201.1-290.3)(20{,}000)}{0.65(13{,}000)} = 2{,}150 \text{ lb/hr}$$

Total coal for the four month summer season is

$$\frac{2{,}150(120)(16)}{2{,}000} = 2{,}065 \text{ ton}$$

Average annual fuel consumption is therefore

$$5{,}030 + 2{,}065 = 7{,}095 \text{ ton}$$

At $4.75 per delivered ton, annual fuel cost is $33,650.

Maximum boiler capacity is 35,000 lb per hr. If plant expansion is anticipated, a standard unit of this capacity would probably be chosen. Where plant output is expected to remain fairly constant for the life of the boiler, a 20,000 or 25,000 lb per hr unit might prove a better investment. During periods of maximum demand by the heating system, the unit would be operated at some point beyond its rated capacity.

Assuming that a 35,000 lb per hr boiler is chosen, total cost for a stoker fired unit might be $70,000, and piping and other equipment directly related to the boiler plant might cost $50,000. Therefore, total cost of the boiler plant would be $120,000. Annual operating costs for this *assumed* plant (Scheme *A*) would then be $90,850, as shown in the Table.

To this must be added the cost of 1,000 kw at 80% load factor for 16 hrs per day, 360 days per year. With current at 1¢ per kwh, cost of purchased power is

$$1{,}000(0.80)\,(\$0.01)\,(360)\,(16) = \$46{,}080$$

Hence, total annual operating cost is $136,930.

Scheme B—Fig. 2 shows the system layout. Two alternatives exist with this scheme; generation of all heating and process steam in the same manner as Scheme A, or utilization of waste heat in the exhaust gases from diesel or gas engines to generate a portion of the heating steam. Calculations are necessary to determine relative costs because there is no general rule which can be applied to cases such as these.

Boiler capacity sufficient to supply process needs is necessary since the quantity of heat available from exhaust gases is usually not large enough to generate 20,000 lb per hr of steam at 250 psia. In fact, under ordinary conditions, waste heat recovered would be just about sufficient to supply half the average heating steam demands.

Assuming that one 25,000 lb per hr boiler and two 500 kw diesel engines are selected, annual operating costs might work out about as listed under Scheme *B* in the accompanying Table.

Scheme C—Fig. 3 shows the system layout. A condensing extraction turbine operating at a throttle pressure of 250 psia with 20 psia extraction for building heating provides another means for solving this problem.

Process steam requirements remain the same, 20,000 lb per hr. The 20 psia steam supplied to the building heating units is now wet, with an enthalpy of 1080 Btu per lb. Steam required is

$$\frac{4{,}130{,}000}{1080-196.2} = 4{,}680 \text{ lb/hr}$$

Work done by a pound of steam before being bled is equal to the difference between throttle enthalpy and bleed point enthalpy, or

$$(1201.1-1080) = 121.1 \text{ Btu/lb}$$

One pound of steam passing through the turbine without being bled does

$$(1201.1-952.0) = 249.1 \text{ Btu/lb}$$

of work when back pressure is 1 in. Hg absolute and moisture is about 13.5%. Assuming a generator efficiency of 94% and a boiler efficiency of 65%, energy generated by bled steam is

$$\frac{4{,}680(121.1)(0.94)}{3413} = 156 \text{ kw}$$

Hence,

$$1{,}000-156 = 844 \text{ kw}$$

must be generated by steam passing to the condenser. To produce this energy,

$$\frac{844(3413)}{249.1(0.94)} = 12{,}300 \text{ lb/hr}$$

of steam is needed. Total average steam flow through the turbine is therefore

$$4{,}680 + 12{,}300 = 16{,}980 \text{ lb/hr}$$

and the boiler must supply

$$16{,}980 + 20{,}000 = 36{,}980 \text{ lb/hr}$$

at unity load factor.

However, the plant load factor is 0.80, and average electrical load is

$$0.80(1{,}000) = 800 \text{ kw}$$

Since bled steam supplies 156 kw, 800 kw less 156 kw or 644 kw must be supplied by steam passing to the condenser. Required flow is

$$\frac{644(3413)}{249.1(0.94)} = 9{,}400 \text{ lb/hr}$$

during periods when heating steam is extracted. Total average flow at plant load factor is

$$9{,}400 + 4{,}680 + 20{,}000 = 34{,}080 \text{ lb/hr}$$

which must be supplied by the boiler. By similar calculations flow during maximum heating load is found to be 40,200 lb per hr. During the summer when no heating steam is required, 31,650 lb per hr are needed for process and electrical loads.

Fuel consumption during the heating season when feedwater, fuel, and boiler conditions are the same as in Scheme *A*, is 7,460 ton. During the summer consumption is 3,390 ton. Total annual consumption is therefore 10,850 ton and the cost is $51,600.

Annual costs would then be $132,600 approximately, as listed under Scheme *C* in the Table.

Scheme D—Fig. 4 shows the system layout. Use of high-pressure, superheated steam as shown on the cycle diagram will usually reduce annual operating costs. Summarizing the principal results for this cycle, after making calculations in a manner similar to those for Scheme *C*, the following is found.

Process steam flow is 20,000 lb per hr, average heating flow is 4,630 lb per hr, and maximum heating 16,150 lb per hr. Electrical power generated by process steam is 300 kw, by heating steam 210 kw during an average heating day, and by additional throttle steam 490 kw. Total throttle steam flow at the plant load factor during an average winter day is 28,450 lb per hr. For maximum heating conditions, bled heating steam generates 833 kw and process steam 300 kw.

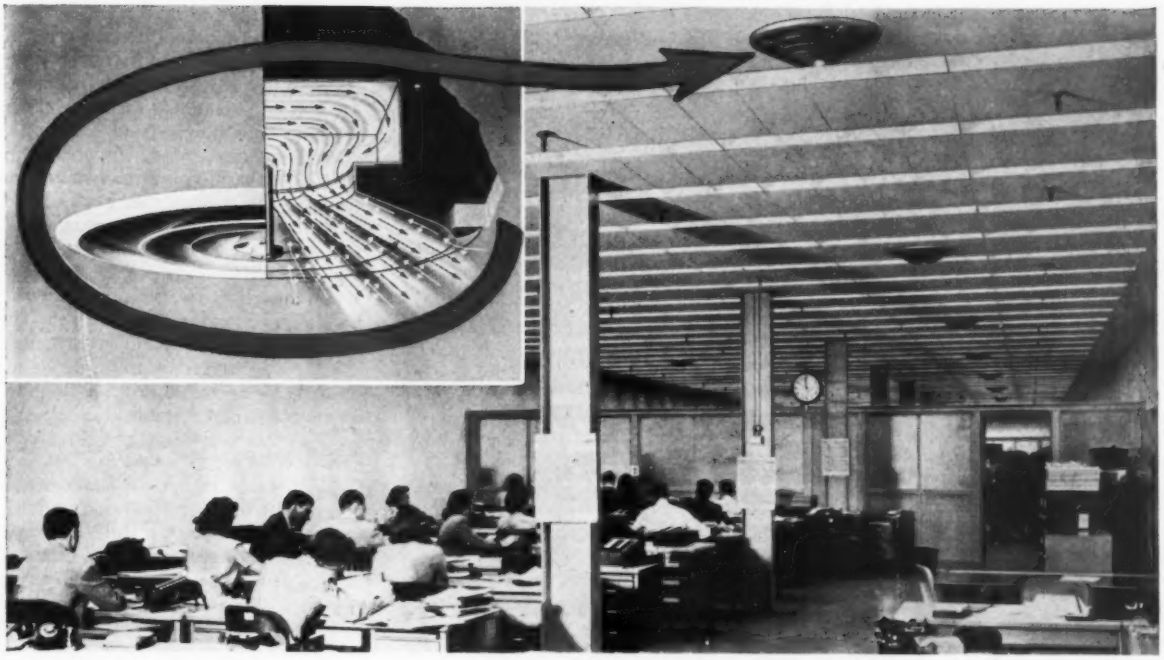
Since power supplied exceeds process requirements, no steam will go beyond the 20 psia extraction point to the condenser. All steam flowing between the 250 psia and 20 psia extraction points

(Continued on page 156)

BREAKDOWN OF ANNUAL OPERATING COSTS FOR THE FOUR PLANTS

Item	Scheme A	Scheme B	Scheme C	Scheme D
Depreciation (15 yr life):				
Boiler plant	$8,000	$5,750	$11,300	$11,680
Engines and equipment	....	8,700	....	....
Taxes and insurance, 6%:				
Boiler plant	7,200	5,160	10,200	10,500
Engines and equipment	....	7,800	....	....
Maintenance and labor, 20%:				
Boiler plant	24,000	17,240	34,000	35,000
Engines and equipment	....	....	....	....
Return and interest on investment, 15%:				
Boiler plant	18,000	12,900	25,500	26,250
Engines and equipment	....	19,500	....	....
Fuel cost:				
Boiler plant	33,650	23,200	51,600	33,100
Engines and equipment	....	34,400*	....	....
Total annual operating cost	$90,850	$134,650	$132,600	$116,530

*Includes maintenance and labor.



Air distribution is the key to eliminating drafts in a conditioned space. Primary and room air are mixed in "Aspirating" diffusers

Warm air system permits positive control of atmospheric environment when

HEATING INDUSTRIAL BUILDINGS

F. HONERKAMP, Chief Engineer, Anemostat Corp. of America

FINAL DESIGN of an industrial plant is likely to be influenced by most of the following factors: personnel relations, new materials, change in structural design, production layouts, roofs and walls, column spacing, heating and ventilating, air conditioning, windowless vs daylight construction, interior color, eating facilities, sanitary facilities, recreation facilities, outdoor facilities, parking, landscaping, and acoustics.

These enumerated items are interrelated, and a saving effected by a certain procedure may be offset by a loss somewhere else. So heating and ventilating a plant is definitely influenced by the type of buildings selected and will, to a certain degree, influence the choice of system.

For example, to install a flat roof instead of a monitor will effect a material saving in first cost of construction. But, provision for ventilation and lighting to make up for that lost through lack of monitors may completely neutralize the saving. Certain operations such as foundries and forge hammers will definitely require the light and ventilation which monitors provide.

Natural ventilation is unsatisfactory in many cases, as it depends on wind pressure and gravity. The wind drives air through openings in the windward side of the building, and eventually it passes out on the leeward side. Gravity effects result from temperature differences. Cold and relatively dense air displaces warmer and lighter air so that convection currents are set up. In narrow factory buildings, good cross ventilation can frequently be obtained by the provision of large and suitably placed windows, or by a combination of windows and wall ventilators. In wide buildings of the steel mill type, window ventilation alone is likely to be inadequate. Special ventilators have been developed for installation in the roofs of industrial buildings that are either stationary, pivoting or oscillating and rotating. Natural ventilation generally can only be effective in the summer time with wide-open buildings, and in localities where it seldom becomes cold enough to worry about heat loss.

Heating of industrial buildings is now usually accomplished by one of the following systems: (1) steam, (2) warm air, (3) direct-fired heaters, and (4) hot water. Heating is very closely associated with ventilation and in many cases the same equipment serves all or part of both purposes. It is not possible in this connection to discuss all heating systems used in industrial buildings. However, a few of the more popular methods will be covered.

In steam heating systems, the steam unit heater has been generally accepted as an excellent means of heating industrial and commercial spaces, and accounts for a large share of the nation's industrial heating. Down-blow, propeller-type unit heaters especially, are installed extensively for the heating of large factory areas and may be well considered standard equipment in the average plant today. Their advantages are manifold: (1) Low installation cost owing to standardization and

High ceiling discharge of conditioned warm air from diffuser produces an even heat distribution throughout the space. Outlets are set in the center of the bay, with the ducts in the steel structure

quantity production, (2) low operating cost, (3) they free floor and wall space for other purposes, (4) at higher levels they do a much better job of floor coverage with the same size unit, (5) heat output can always be made to suit the demand, and (6) they give great flexibility to the heating system, one of the most important requirements in the heating of today's industrial buildings.

Disadvantages of unit heaters which have to be overcome are: tendency to cause steep temperature gradients, and the possible exposure of workers to unpleasant air currents. In attempts to prevent complaints about unsatisfactory heat aand air distribution, directional grilles and adjustable louvres have been attached to the bottom plates of unit heaters. But, the best all-round results are obtained when "aspirating" air diffusers are applied for the purpose of uniform, draftless air distribution. Two types of "aspirating" air diffusers are available for the job, one for high mounting heights, the other for low applications. Both provide economical and uniform heat coverage of the floor area and offer negligible resistance to the air discharged from the heater.

Warm air heating systems meet industrial requirements better than unit heating, but they are more expensive. This method provides ventilation as well as heating, and in the form of air conditioning permits absolute control of industrial atmospheric environment.

It has been pointed out recently that the special problems of modern industry and further demands for better production standards, safety, plant working conditions and controlled process conditions have all greatly increased the scope of the warm air system and have accelerated its scope. Where straight heating is satisfactory, the steam system will prevail, but where special air handling problems are involved, the warm air system will be indicated and often required. The utilization of warm air for heating is on the increase and will continue to increase as long as industrial requirements continue to mount.

Air Transmission Units

Most important single factor which contributes to the success or failure of any mechanical heating and ventilating system is air transmission and distribution system. The ducts which convey the air to the conditioned spaces have to be planned economically and efficiently. Air distribution outlets must carefully selected and located if the air distribution system is to achieve its goal of draftless and comfortable air diffusion.

A good example of present day methods in plant construction is that of General Electric Company's new turbine factory at Schenectady, New York. This impressive building covers twenty acres of land and has more than a million sq ft of floor space. It is 650 ft wide and 1290 ft long and has nine machinery bays, ranging in width from 60 to 80 ft, and a three-story, 40 ft wide service bay. All the machinery bays are laid out with center aisles running the length of the building. A four-story office building on the south end of the plant has an area of 71,000 sq ft and houses sales engineering, drafting, manufacturing and other activities. Additional manufacturing offices are provided on the first and second floors of the service bay.

Typical Plant System

Heating, ventilating and air conditioning systems of this giant plant can be divided into three large groups. The manufacturing area is heated and ventilated by two systems, offices are air conditioned by the third system.

Eighteen units—comprising the first system—are situated in special fan houses on the roofs of the second bay on the east side of the building. Most of these fans have a capacity of about 60,000 cfm handling capacity, some deliver nearly 80,000 cfm and there are a few with a capacity of 25,000 cfm. Large supply ducts are run overhead to the sides of the bays distributing the air through 45° supply nozzles

15 ft above the floor. Two special nozzles are installed above each door. These nozzles are thermostatically controlled and the heat is automatically turned on as soon as the doors are opened. After the doors have been closed, air is discharged until the temperature is sufficiently high. Four large roof fans remove fumes from the welding area of the last bay.

Situated on the third-story floor of the service bay are 19 units—second system—that serve mainly the four west bays. The overhead duct work terminate with "aspirating" air diffusers. These diffusers discharge 7,200 cfm each. The bottom of the diffuser is level with the bottom of the truss, a mounting height of nearly 32 ft. All diffusers are equipped with equalizing deflectors and radial deflectors.

Heated Areas

Five air conditioning units for the office areas are accommodated also on the third floor of the service bay. In the offices of the service bay the duct work is concealed and the air is distributed by ceiling type air diffusers, with capacities range from 500 to 700 cfm. Air returns to the air conditioning units through a perforated ceiling.

Actual figures will give a better understanding relative to the size and task of heating and ventilating this structure. There are 8½ miles, or nearly 45,000 ft of heating and ventilating ducts. The entire system handles 150 million cfh or 2½ million cfm. Under ordinary conditions an air supply of 25 cfm per person is now considered adequate. Therefore, the air moved through the heating and ventilating system of the turbine plant would be sufficient to care for a city of 100,000 inhabitants, that is to say for the entire city of Schenectady. Actually, approximately 5,000 persons will be employed in the completed plant.

There has been much progress in the design of industrial buildings during and since the end of World War II. The modern industrial plant is no longer simply a place to work, but presents a successful example of an efficient and comfortable environment. Industrial architecture, rarely known fifty years ago, plays an ever increasing role in the further development of industrial buildings, adapting them architecturally to the necessities of our time and making them highly impressive of the present age. Certain types of buildings, which have evolved during the course of industrial progress, are still representative of the different needs of various kinds of manufacturing processes. They are catalogued as follows:

1. The single story building of the weaving-shed type with saw-tooth roof.
2. The high one-story building with large truss space generally known as steel mill buildings which provides large spaces for machinery and traveling cranes.
3. The multi-story building, until recently generally used for light manufacturing and warehouse purposes.

Multi-Story Factories

City factories usually are housed in a multi-story building of the loft type. For the plant in the country area the one-story building is now considered an ideal solution, since large sites are practical and expansion presents no problems. Today such buildings are often selected for light manufacturing purposes. Furthermore, the development of mechanical handling systems has made it possible for many industries to function well in a one-story building, lowering cost and increasing flexibility.

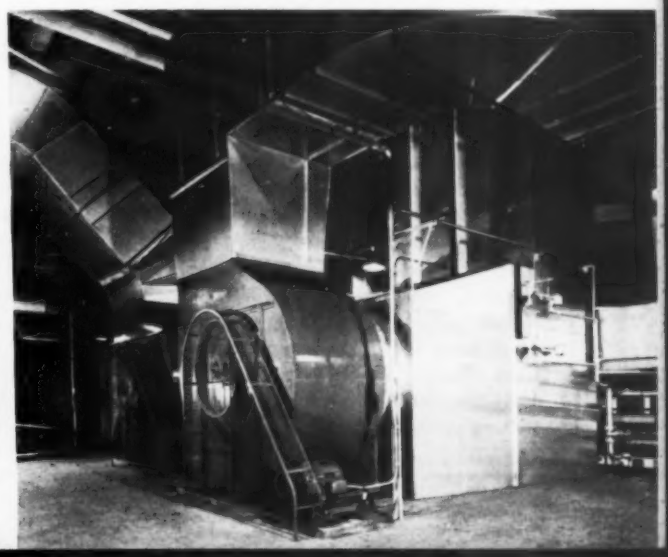
Location and design of the modern industrial plant depends on many factors, which must be carefully evaluated before deciding on the site and construction of a building for manufacture of a specific product. It is not practical to discuss here the various considerations, which may enter into the selection of a suitable site. But, it is rather obvious that some plants, of necessity, must be situated in cities. Others can be built in less congested areas. Frequently selection of a site will be decisively influenced by its relation to major markets and the availability of a capable working force. In all cases, however, the trend of present-day planning includes ample consideration of employe comfort and health. Air conditioning, heating and ventilating are playing an ever-increasing role in this new-era construction and development of industry.

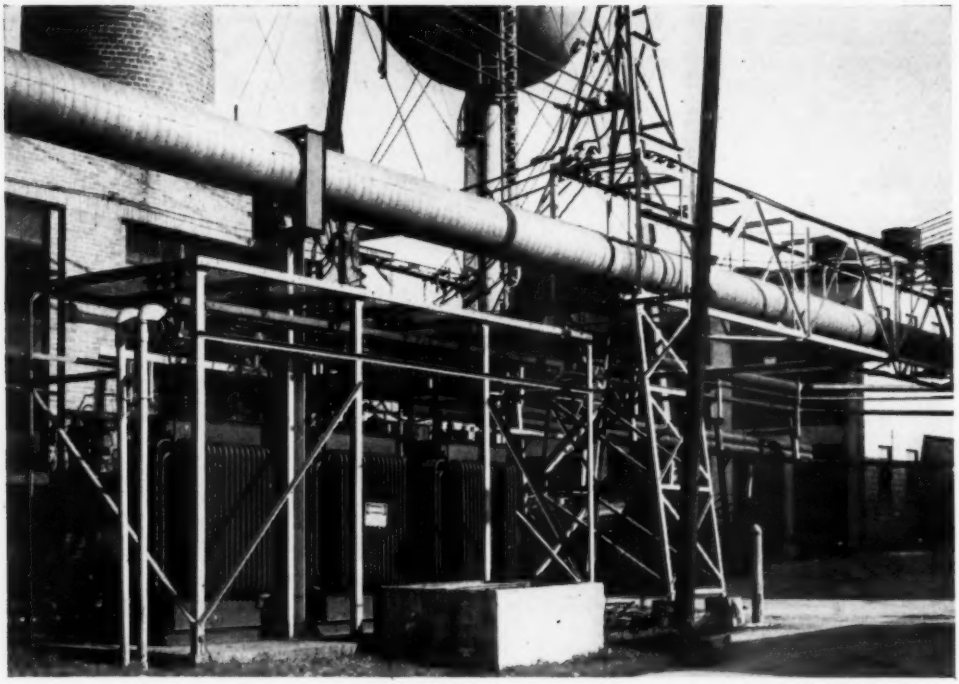
It is always easier and less costly to plan for the installation of a ventilating system when the building is erected. Even if money is not available at that time, it provides for arrangement of other equipment, piping, crane runways, etc. for least expenditure of labor and material when ventilating units and ducts are installed later.

Cutting openings in the roof for vent hoods usually require the installation of strengthening members, which makes the job more complicated than if they were put in during erection. The same applies to heavy duct work—leave room for straight runs so interfering equipment does not have to be relocated, or the duct work run around it. Whether you plan a central system or individual units depends on the type of building, weather conditions, product manufactured, and kind of work performed.

Labyrinth of ducts provides means of transporting clean, heated air under controlled ideal conditions

One of the central units, which contains a volume type fan and steam heating equipment in steel casing





Transformer bank ties in the old 600 v line with new equipment generating at 2400 v. Turbine exhaust to plant passes overhead

TEXTILE FINISHING PLANT COMPLETES SIXTH MAJOR EXPANSION

Second 150,000 lb per hr boiler, a 5000 kw turbine generator, and 2400 v switchgear are added to plant to meet increased electrical and process-steam loads

J. C. PORTER, Power Engineer
Rock Hill Printing & Finishing Company

STARTING in 1929 with steam capacity of 75,000 lb per hr and generating capacity of 1500 kw, this company made successive additions to the plant until in 1947 capacities were 350,000 lb of steam per hr and 3500 kw. When greater steam and electrical demands occurred as a result of new processing machinery installed in the mills, standby power plant equipment proved to be inadequate.

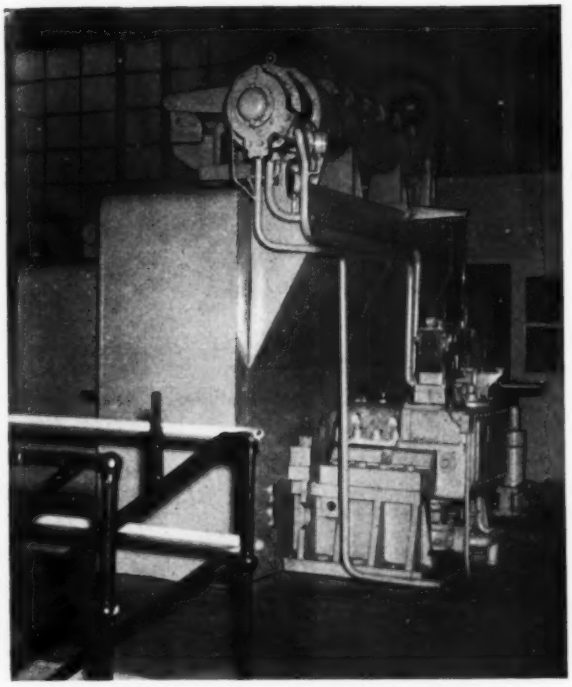
Therefore, a second 150,000 lb per hr pulverized-fuel fired boiler was installed, together with a 5000 kw non-condensing extraction-type turbine-generator. The latter unit, generating at 2400 v, was tied into the existing 600 v power plant bus through a 2400/600 v transformer bank. Factors affecting selection and installation of this new equipment are discussed by the author. He also discusses the method of utilizing older boiler auxiliaries for compatible operation with new units

ROCK HILL, South Carolina, is the home of one of the largest textile printing and finishing plants in the world. Owned and operated by the Rock Hill Printing and Finishing Company, it completes the processing of cotton and rayon print goods. This plant started operation in 1929 with a maximum steam production capacity of 75,000 lb per hr, and a generating capacity of 1,500 kw. Neither of these capacities at that time were even nearly approached by plant load demands.

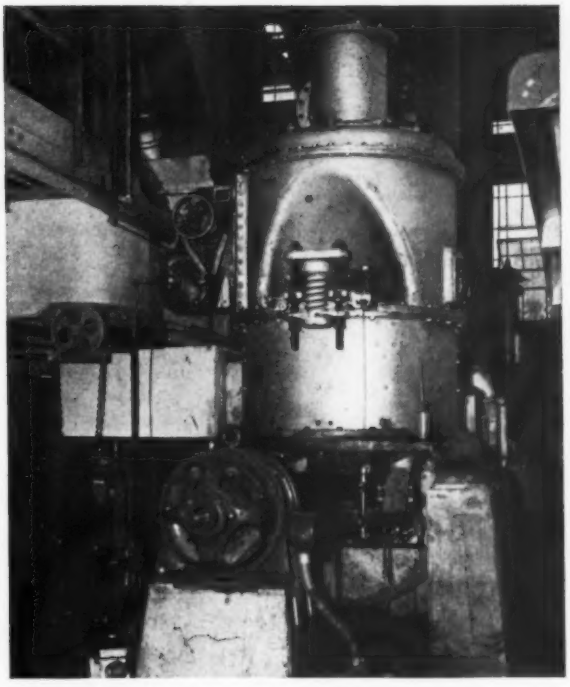
Plant growth was rapid. Successive additions to the boiler plant, and one addition to the electrical generating plant, resulted in capacities at the end of the war of 350,000 lb of steam per hr, and 3,500 kw.

Installation of additional production machinery since 1945 necessitated greater electrical and steam-generating capacity. Extensive studies were made to determine what equipment was necessary to meet not only current demands, but also maximum demands anticipated in future expansion.

Electrical demand increased rapidly until early in 1947 it amounted to



Steam end of new turbine. Non-condensing extraction type was chosen because of heavy steam load in plant



This is one of two pulverizers installed with the new boiler. Boilers are equipped for dual coal-oil firing

3,500 kw. An increase of at least another 600 or 700 kw was seen for the very near future. At that time, considerable exhaust steam in excess of plant process requirements was being blown to atmosphere at an annual estimated cost of approximately $15,000. This condition, together with the already overloaded generators, made it imperative that additional capacity be installed as quickly as possible.

Previous studies proved that increasing steam generating pressure above the existing 250 psi was not only unnecessary to reach a satisfactory steam-power balance, but it would also be extremely expensive to install and would present many operating difficulties inherent in a topping type of installation. In view of the fact that large quantities of steam at 90 to 100 psi, as well as at 15 psi exhaust pressure, are required in plant process work, it was decided that the best possible installation would be one large turbine generator arranged for a throttle pressure of 230 psi at 575° F, bleeding at a controlled pressure of 100 psi, and exhausting at 15 to 20 psi.

This would not only handle the then anticipated full plant load, but would result in an exhaust steam balance which would save all steam flowing to the atmosphere; also, it would allow for some make up to add flexibility to plant processes. The existing units would be available for standby service to handle loads in excess of the capacity of the new unit should the need arise, or they could be converted to high pressure operation for topping service should this ever be necessary.

Selection of Turbine

A 5,000 kw non-condensing extraction turbine-generator unit was purchased. It has sufficient flexibility between extraction and back-pressure to accommodate variations in medium pressure and low pressure requirements, and at the same time carry the electrical load, which might vary from 3,000 to 5,000 kw.

Two older machines generated 600 v while this new 5,000 kw unit generates at 2,400-v 3-phase, 60 cycle. It is connected to the existing 600 v power plant bus through new metal-clad switchgear, and a 2,400/600-v 3-phase transformer bank adjacent to the turbine room. With this high voltage, it was possible at the time of installation to relieve an overloaded condition on 600 v feeders to the main plant distribution center by carrying a 2,400 v line to this load center, and installing another 2,400/600 v unit sub-station. Several years ago when replacement of underground cables became necessary, the possibility of improving the overload was foreseen and 5,000 v cables were installed. These lines now provide distribution for the new 2,400 v system.

Switching arrangements permit full use of the two small units, either with the new unit or separately as required.

LIST OF PRINCIPAL EQUIPMENT AT ROCK HILL PLANT

Engineering	Lockwood Green and local Plant Engineers
Turbine-Generators	Worthington Pump and Machinery Corp.
Switchgear	General Electric Co.
Water Pumps	DeLaval Co.
Fuel Oil Pumps	Worthington Pump and Machinery Corp.
Boiler	Combustion Engineering-Superheater, Inc.
Pulverizers	Raymond Div.
Fans	Clarage Fan Co.
Auxiliary Turbines	Elliott Co.
Pulverizer, Fan Motors and Controls	Westinghouse Electric Corp.
Coal Scales	Richardson Scale Clo.
Meters and Controls	Republic Flow Meters Co.
Piping	Grinnell Co.
Breeching	J. L. Hamilton Engineering Co.
Gunniting	Pressure Concrete Co.

Synchronizing connections were made so that full flexibility of operation of the various units was retained.

All new equipment has been in service for approximately four months, carrying loads up to 4,400 kw, and results have been all that were anticipated. In fact, performance is so good that with 4,400 kw approximately 15,000 lb per hr of steam is bled from the 90 psi extraction system to the 15 psi system to make up a deficiency in this low-pressure system. This compares to the loss of approximately the same amount of low-pressure steam to atmosphere before the new machine was put into operation. The loss to atmosphere under the old conditions represented approximately $15,000 per year. However, with the increrased load now being carried, this loss would amount to approximately $25,000 per year under the old conditions had a straight back-pressure turbine been installed.

Improvement in the low-pressure steam balance has made it possible to change some drying units in the plant to higher pressure steam, thereby increasing the over-all production of these machines without increasing space requirements or operating labor. The change from 600 to 2,400 v generation, and from straight back-pressure to extraction-type service, has been well justified not only by all of the benefits described but also by simplifying high-voltage switchgear buses, generator connections, and related units.

Selection of Boiler

Whereas, it was recognized that additional steam generating capacity would also be required, the need was not as acute as electrical generating capacity. The installation of a boiler was therefore delayed and finally made as a separate project. The plant started originally with three 400 hp sterling type stoker-fired boilers. Subsequently, the following additions were made: one 550 hp stoker-fired boiler, two 770 hp stoker-fired boilers, and finally in 1941, a 150,000 lb per hr pulverized coal fired boiler.

The pulverized coal fired boiler, having given excellent service with an extremely small amount of unscheduled outage time, seemed to have been an excellent investment. However, there was one major drawback: it was carrying approximately one-half of the total plant load and there was no spare capacity to take care of plant production should this big unit go out of service. Recognizing the fact that uninterrupted operation of the cotton mills depended on full production in the finishing plant, management was not willing to take the chance of jeopardizing production by not having ample steam generating capacity.

Studies of competitive prices, space requirements, arrangement, delivery and operating characteristics of existing boilers indicated that the best and cheapest installation could be made in the shortest possible time by duplicating as nearly as possible the existing pulverized coal unit having a capacity of 150,000 lb of steam per hr. Such a unit was purchased and its installation, together with related equipment, was completed in late 1949. This unit duplicates the one installed in 1941, excepting minor changes that the manufacturers have made on the pulverizing equipment, the arrangement of slag-screen tubes in the furnace, and fan and pulverizer drives.

Auxiliaries in the original steam plant are all turbine driven, and cannot, therefore, be put in service without an outside source of steam. As the plant shuts down each weekend, and as there will be many times when only the two pulverized coal units will be required, it was decided that the pulverizers of the new unit should be motor driven with dual motor-turbine drive on the induced draft fan. The forced draft fan is turbine driven. Both fan turbines are arranged for remote speed control, either manual or automatic. Standby power for weekend use and starting up is purchased from the local utility.

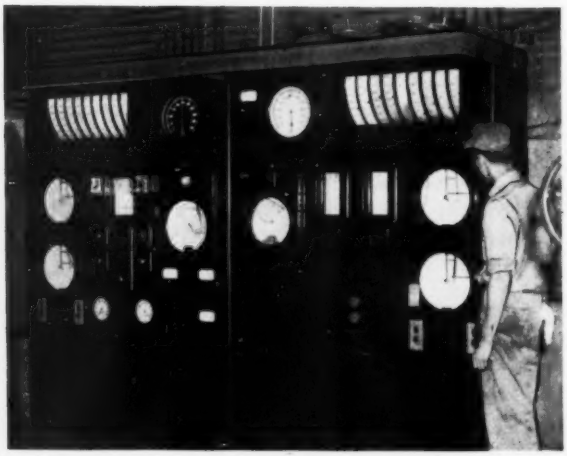
Boiler Auxiliaries

At the time studies were being made for the new boiler, it was recognized that the water heater, returns pump, and the boiler feed pump capacity were all barely adequate for the then existing load, and additions would be necessary for even a very small increase in steam production. Steam load in the plant amounted to 350,000 lb per hr. As it was proposed to install a 150,000 lb per hr unit, it was decided that auxiliaries should have sufficient capacity to accommodate the full generating capacity of the boiler room, even though this production would not actually be required for a number of years, if ever.

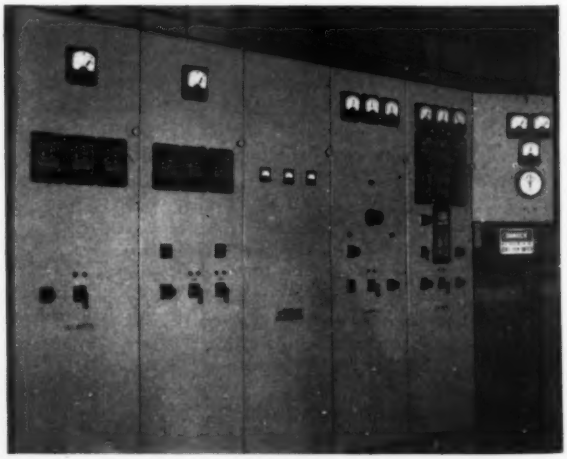
As the result of successive additions, the power plant had acquired three small deaerating heaters. These units were operating in parallel but were causing some difficulty with the load distribution. It was decided that adding another heater and trying to operate four in parallel would be unwise; therefore, a single 500,000 lb per hr heater was purchased, installed outdoors adjacent to the pump room, and insulated for weatherproof service. This step was necessary because of space limitations. Along with the heater, a 1,000 gpm turbine driven feed pump and a 1,000 gpm motor driven return pump were purchased. These units handle all return condensate; as well as boiler

(Continued on page 158)

Control and instrument boards for old and new 150,000 lb per hr pulverized-fuel fired units are side by side



Underground 5000 v cable installed two years ago now distribute the new system's 2400 v via this switchgear



INDUSTRIAL PLANTS

THERE ARE THREE common reasons for floodlighting the industrial plant—protection from intruders, illumination of outdoor work areas, and advertising. Usually, floodlighting for any of these purposes is easily justified. Equipment cost is moderate, its life will equal that of the plant, and operating costs are low. Advantages gained are many. The lighted structure is a constant reminder that here is one of the plants where a certain product is manufactured, unwanted intruders are more readily detected by watchman, and characteristics which management wishes to have associated with a product can easily be emphasized.

Good floodlighting requires application of certain lighting principles. Areas illuminated are large, distance between floodlight and plant may be great, variation of light location or projection angle will emphasize certain characteristics of the structure and soften others, and light pattern obtained may produce a pleasing or harsh effect, depending on the skill with which lights were chosen and arranged.

The Floodlamp

Manufacturers have, to a certain degree, standardized floodlamp construction and characteristics. Therefore, it is possible to make several generalizations about floodlamps which will apply to all usual industrial applications.

Three beam spreads are commonly used for floodlamps. The total range of these spreads is from slightly greater than zero up to about 90°, as shown in Fig. 1. The light pattern may be round or oval, according to the cover lens used. When round, the beam spread angle is equal in both the horizontal and vertical directions. For instance, as shown in Fig. 1, a 30° circular beam spread has its outermost rays 15° from all sides of the centerline of the floodlamp.

Oval or elliptical beam patterns can be arranged with the wide angle-spread in either the horizontal or vertical direction, Fig. 1. The narrow angle spread is generally about one-fifth of the width, though many different combinations are possible by various types of lamps. Lamps designed for circular beam patterns can be arranged to produce oval or elliptical patterns by raising or lowering the reflector and lamp so that the center line of projection is at an angle other than 90° with the structure surface, Fig. 2. Generally, better illumination is obtained when the lamp is designed specifically for the beam pattern desired, but a knowledge of the various effects obtainable with different types of floodlamps is often useful. Table 1 shows typical beam spreads for various combinations of bulbs and lenses.

Floodlamp Construction

Basically, there is nothing radically different in the construction of a floodlamp, the principal parts being an incandescent lamp, lens, and a reflector of suitable size and shape. To obtain maximum light output with a given size lamp and reflector, the lamp is located at the focal point of the reflector. Under these conditions rated beam spread and maximum illumination are

easily secured. A quantitative measure of the effectiveness of any lamp-reflector combination is given by its *efficiency of projection,* or the ratio of maximum obtainable light output in lumens to maximum light output of the bare lamp, also measured in lumens.

Lenses may be plain, lightly stippled, or heavily stippled, according to the quality of light desired. Plain lenses are used where the only requirement for light quality is brightness; here, irregular intensity and harshness of the light is unimportant. Thus, plain lenses are frequently applied where floodlighting is used for protective purposes, though, of course, they have many other uses, depending on the exterior surface of the structure and reasons for floodlighting.

Stippled lenses enhance the appearance of a structure by giving the light a soft quality and reducing irregularities in light intensity on the surface. They overcome certain of the undesirable characteristics inherent in any reflector, cover plate, and lens. The degree of stippling required depends, to a certain extent, upon the quality of light desired and the surface illuminated. These factors will be discussed more completely later.

Manufacturers usually classify outdoor floodlamps as open or enclosed types. Open floodlamps have aluminum or porcelain enamel reflecting surfaces and a weather guard to protect the lamp from snow and rain. Enclosed lights are generally fitted with a silvered glass, anodized aluminum, or porcelain reflector and a watertight lens which may be of the plain, stippled, or spreading type. The reflector may be stippled instead of the lens.

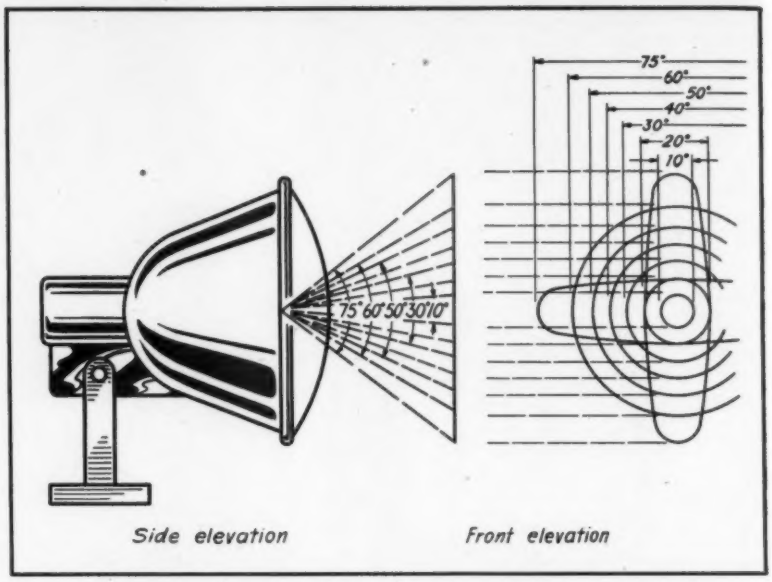


Fig. 1—Both circular and elliptical beam patterns are obtainable with standard floodlights when fitted with suitable lenses. A few of the patterns most commonly used are shown in these two drawings

TABLE 1—FLOODLAMP BEAM SPREADS

Lens type:	*PS-general service*	*G-bulb floodlamp*
Horizontal spread	50° x 10°	50° x 20°
Vertical spread	50° x 10°	50° x 20°
Plain	13° x 13°	25° x 25°
Light stipple	30° x 30°	35° x 35°
Heavy stipple	40° x 40°	50° x 50°

Efficiencies

The more efficient a floodlamp is, the greater the amount of light which will be confined within its specified beam spread. However, many factors influence the light entering the beam spread and as a result beam efficiencies usually range somewhere between about 10 and 50%. Light absorption by the reflector, imperfect mirrors, diffusion and absorption of light in lens cover glasses account for the reduction in floodlamp beam efficiency.

On first examination, the seemingly low beam efficiency of the floodlamp might discourge its use. However, very little of the light from the lamp is lost. Instead, it "spills" out beyond the beam spread, giving light over a greater area. Where the wall of an industrial plant is to be floodlighted, the spilling out action usually enhances the effect obtained and produces more equalized intensities. In addition, overlaps of circular beams become less noticeable when same spilled light reaches the illuminated surface. Hence, the beam efficiency may be a somewhat misleading term unless the purpose for which the floodlamp is used is also stated.

For slender objects, such as a power plant stack, industrial sign, or small water tank, low beam efficiency may impair the effect of floodlighting. The excessive amount of spill light illuminates nearby secondary structures, reducing the impressiveness of the single object which it is desired to emphasize. Therefore, in cases such as these, beam efficiency has a greater effect on lamp selection than when a large area is to be illuminated.

The overall efficiency of a floodlamp, an expression which includes both spill and beam light, ranges from about 50 to 75%. This means that anywhere from 50 to 75% of the light produced in the lamp reaches the exterior and therefore acts to provide the illumination. Overall efficiency does not provide an accurate estimate of the intensity of illumination produced; for that intensity, the beam efficiency must be consulted. A floodlamp with a 100% beam efficiency would produce maximum light intensity on the wall or structure because all the light is confined to the beam. As beam efficiency decreases, spilled light increases. Overall efficiency, however, could conceivably remain the same while beam efficiency varied widely.

Projection Angles

The angle at which the beam strikes the structure not only affects the light pattern obtained, but it also changes the amount of light reflected. Since the light reflected determines the overall effect of the floodlighting

TABLE 2—RECOMMENDED INTENSITIES

Structure floodlighted:	*Foot-candles*
Signs	10 to 30
Smokestacks	8 to 12
Water tanks	8 to 12
Material floodlighted:	
Bricks	
Smooth face, buff	10 to 15
Gray	10 to 15
Common red	15 to 30
Common tan	15 to 20
Terra cotta:	
Cream	5 to 10
White	5 to 10
Sandstone	10 to 20

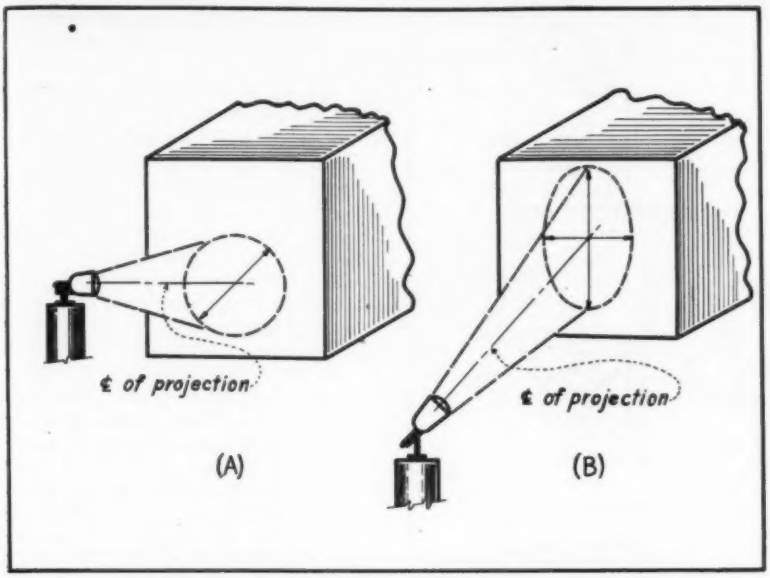


Fig. 2—(A) Vertical projection against the building wall produces a circular beam pattern when a lamp with this type beam is used. Non-vertical projection (B) produces an elliptical pattern

system, it is an important consideration in planning.

Right angle projection, Fig. 3A, provides the greatest amount of reflection from a surface of given material. Moving the light 10 to 20° away from a right angle position will reduce the reflection obtained, but the reduction is not appreciable when considered in terms of usual industrial floodlight applications, Fig. 3B. With a large departure from the perpendicular condition, Figs. 3C and 3D, reflected light is reduced considerably, necessitating use of higher wattage floodlamps.

Regardless of projection angle, it should be noted that floodlights cannot produce a daylight effect. The illumination to be secured must therefore receive careful study because it cannot be analyzed in terms of the daylight appearance of the plant or structure. A divergence from the perpendicular by rays of a circular beam pattern also produces the oval or elliptical shape earlier described.

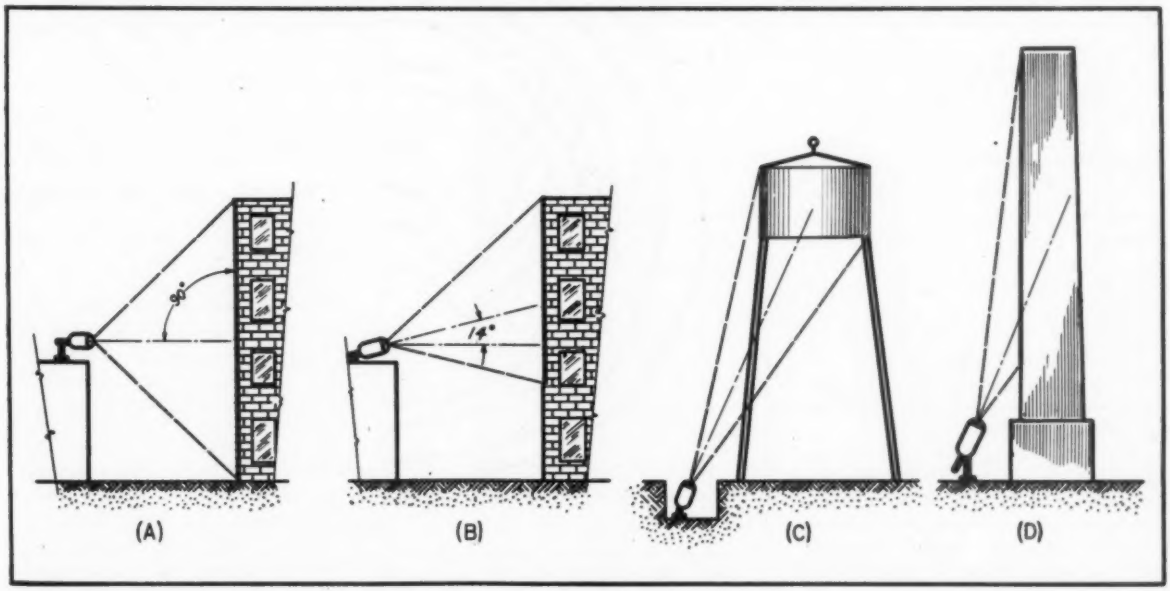
When selecting projection angles it is necessary to recognize that little if any light is reflected from nearby structures to the lighted one. Light which does not strike the structure to be illuminated is lost and represents a waste of power. In addition, about 10% overlapping of the beam pattern is usually necessary for uniformity of illumination. Where the exterior material of the building or structure has a reflection factor of 20% or less, it is usually uneconomical to floodlight for advertising purposes. Security, however, may require floodlighting regardless of the cost involved.

Narrow beam floodlights (up to 15° spread) should be used for areas which are distant from the light source. Broad beam equipment (30° and larger spreads) is most frequent applied to near areas. Intermediate distances may use medium beam floodlights (16 to 29° spreads).

Intensity Required

Two factors determine intensity required: (1) materials of construction used in the building or structure, and (2) surrounding lighting conditions. The reflection factor and color of the surface are major elements influencing wattage necessary. Where surrounding buildings are brightly illuminated, a much greater wattage is needed to provide the desired intensity for advertising purposes. Where only protection is

Fig. 3—(A) Vertical projection produces the greatest reflection from the lighted surface. (B) Moving the light away from the vertical position reduces the reflection. (C) and (D) With a large departure from the perpendicular condition, reflected light is considerably reduced and higher wattages are therefore required



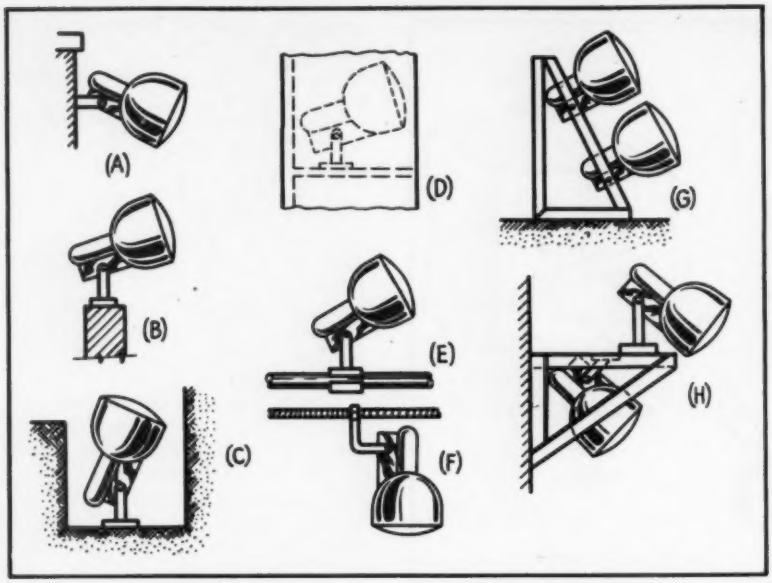


Fig. 4—Mounting arrangements for floodlights: (A) Wall, (B) pole, (C) light well, (D) pylon, (E) steel pipe, (F) steel cable, (G) angle stand, (H) wall bracket. Many other mountings are available

sought, light from surrounding structures may aid in increasing the area illuminated but such lights will not reduce the wattage required. This results from the fact that the lights of other structures cannot be relied upon when the need for protection is sufficient to warrant installation of a floodlighting system.

Table 2 shows intensities which have been found suitable for various buiiding materials and certain types of industrial structures. Use of these data requires some judgment because local conditions may alter illumination needs. However, they are offered as a guide for those cases in which there is no previous experience to govern intensity choice. They have been widely used for floodlighting of new and existing plants and have been found satisfactory for all normal applications.

Floodlamp Locations

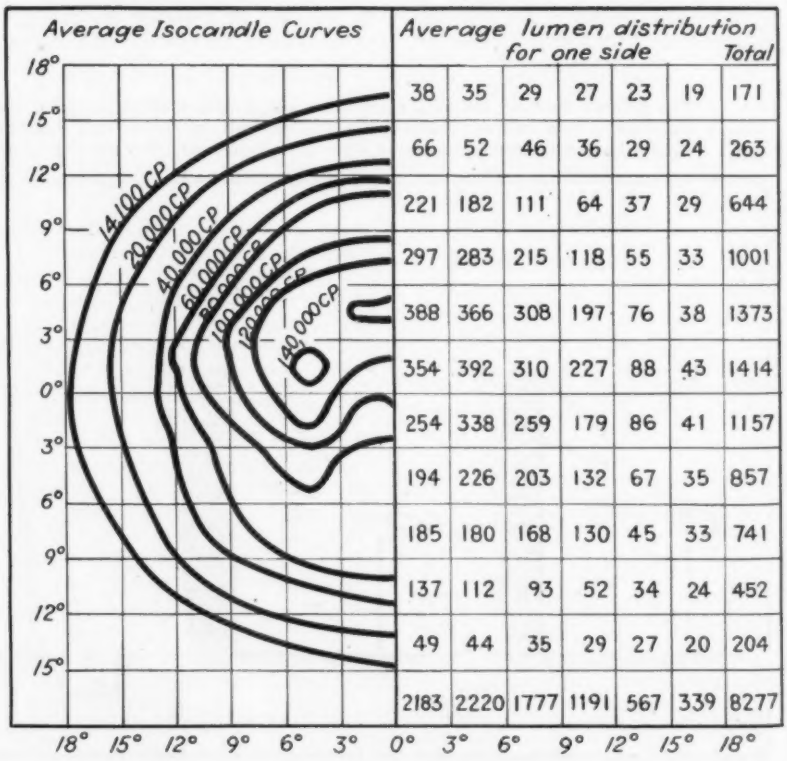
Floodlamp location is dependent on surrounding buildings, area to be illuminated, topography, and relative cost of equipment for supporting the lights in various locations. In general, floodlights can be mounted either on the building itself, on the ground, or on other nearby structures. Ledges, cornices, parapets, setbacks, and light wells are the most common location for lights on the building itself.

When located on plant grounds, the lights can be supported in trees, on special poles installed for that purpose, decorative pylons, concrete slabs embedded in the earth, stepped platforms made of angle irons, or fastened to street lighting standards when building height does not exceed three stories. Location of floodlamps on nearby buildings is particularly good for tall plants because the angle of projection can usually be made perpendicular or close to it.

Regardless of where the floodlamp is located it is common practice to hide the source if at all possible. This procedure is in keeping with the general purpose of floodlighting; i.e., production of a pleasing, softly lighted scene which does not distract the spectator or observer. Bright, glaring sources which are poorly concealed discourage use of the eyes and in some cases have been known to cause vehicle accidents on roads near the plant.

Fig. 4 shows many of the common means available for mounting floodlights. As can be seen by a study of the various mountings, the method chosen is dependent upon the lighting effect desired, height of building, and general shape of the structure. Shrubbery is often used to conceal floodlamps mounted near the ground. The type of mounting chosen should be one which permits easy maintenance because periodic cleaning of lenses and reflectors is necessary, along with replacement of lamps. Pole and tree mountings, while often desirable from the illumination standpoint, sometimes present maintenance difficulties, especial-

Fig. 5—The beam characteristics of a floodlight fitted with a PS-52 clear bulb rated at 33,000 lumens with a polished aluminum reflector. The efficiency of the beam is 47 percent with a 32 degree vertical spread and with a 35 degree horizontal beam spread



Average lumen distribution for one side						Total
38	35	29	27	23	19	171
66	52	46	36	29	24	263
221	182	111	64	37	29	644
297	283	215	118	55	33	1001
388	366	308	197	76	38	1373
354	392	310	227	88	43	1414
254	338	259	179	86	41	1157
194	226	203	132	67	35	857
185	180	168	130	45	33	741
137	112	93	52	34	24	452
49	44	35	29	27	20	204
2183	2220	1777	1191	567	339	8277

ly during extended periods of rainy or snowy weather.

Wall mounting simplifies maintenance if the floodlamp is near a window; otherwise, it is about equal to tree and pole mounting as far as maintenance is concerned. Pylons are good from all operating and maintenance standpoints but with tall buildings they may have to be excessively high to provide desired illumination.

Light wells increase the initial cost of a structure somewhat but they usually permit excellent lighting because the structure can be studied thoroughly before the installation is made. Steel pipe and cable supports are often the answer to a tricky lighting problem. Concealment of these supports is practically a "must" if daylight appearance of the plant is to be preserved.

Since most industrial applications involve the use of more than one floodlamp, it is common practice to use two or more groups of lamps to provide the desired lighting effect. Overlapping, a necessary part of all floodlighting systems, is more readily secured when two or more groups of lamps are used. Lamps in a group can be arranged in a single horizontal line, vertical line, or banked into several horizontal and vertical lines, according to the extent and height of the surface to be illuminated. Group lighting usually gives softer shadows and permits accentuation of the simple straight lines and curves used in modern industrial structures.

As a general guide in floodlamp location in terms of area illuminated and distance of the light from the structure, Fig. 6 can be used. These curves correlate the three factors most commonly encountered in actual selection of the light once the other factors discussed above have been investigated. The curves are general but they will be found to apply to all usual industrial floodlighting problems where a circular beam pattern projected perpendicular to the surface is used. Since many floodlamp manufacturers are capable of supplying all needed beam spreads, these curves can be safely interpolated.

Lamp Characteristics

Fig. 5 shows typical beam characteristics of a floodlamp. PS-bulb general service lamps and G-bulb floodlighting lamps are the most commonly used types. Exact beam spreads for these lamps can be obtained only from the manufacturer but the general data given in Table 1 are suitable for all preliminary estimates. Test specifications for floodlamps are published by the National Electrical Manufacturers Association and others. Important operating characteristics of floodlamps usually fall within the following ranges.

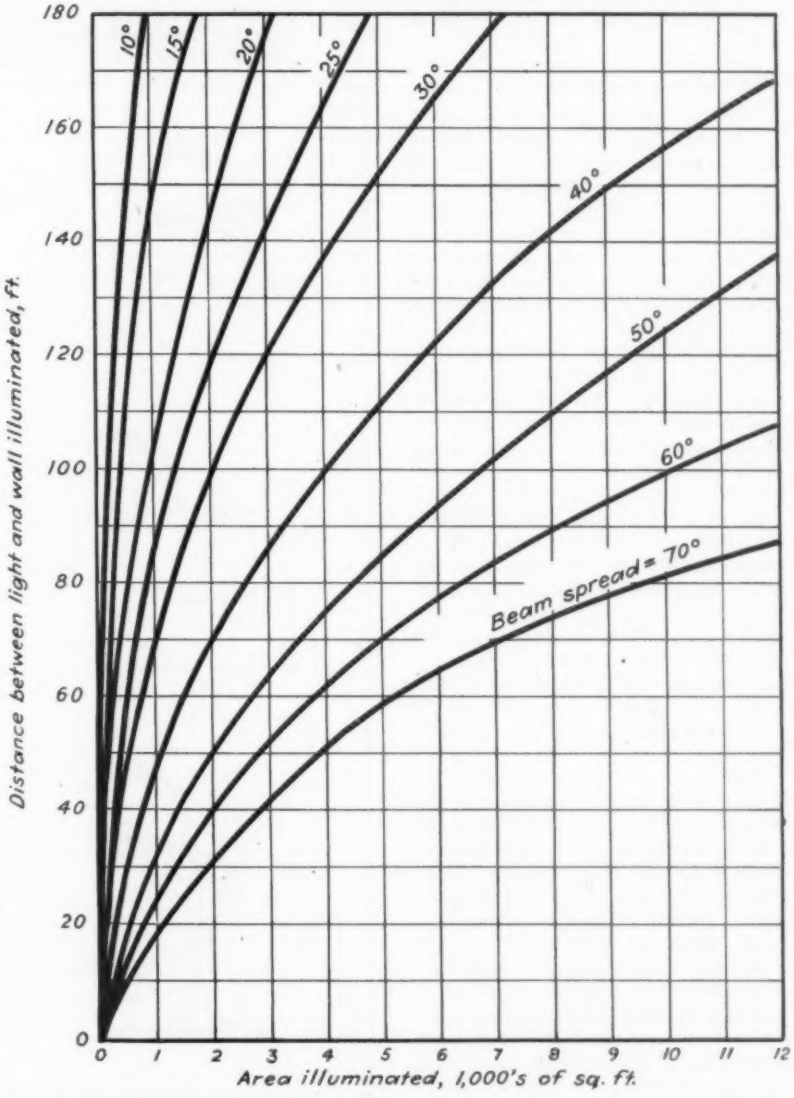
Rated average life is 1,000 hours; lumen output for ordinary industrial service ranges up to 33,000 lumens for 1,500 watt lamps. Mogul type screw bases are most common and the lamp can be burned in any position desired. The lamps are gas filled units for 115 volt service, power requirements varying from 200 to 2,000 watts. They are rated for general lighting service. These statements apply to standard lamps and are not to be taken as limiting maximum or minimum values. Manufacturers are ready to supply such a wide variety of lamps that an attempt to classify all types would lead only to confusion. Standard lamps are usually preferred because they are lower in cost and easier to replace after they have burned out.

Emergency Floodlighting

Floodlamps installed only for advertising purposes do not endanger plant operations when they fail. Where security is involved, failure of floodlights may have serious consequences. Hence, it is common practice to keep two or more extra floodlights on hand for emergencies where the permanent lamps were installed for protective purposes. The major factor to be considered when selecting emergency floodlamps is the intensity of light necessary for observation of the area lighted. This intensity is usually less than that provided by the permanent lamps.

Many types of temporary lamps are available, as shown in Fig. 7. At least

Fig. 6—Areas illuminated by various beam spreads when a circular pattern projected at right angles to the wall is used. These curves are general and are suitable only for first approximations



one battery unit should be kept on hand so that light will be available during periods of power failure. Standard outlet units with long lengths of wire can be placed wherever desired and adjusted to the necessary projection angle.

TABLE 3—AVERAGE REFLECTION FACTORS

Color of material	Reflection factor, %
White	83
Ivory white	80
Pearl gray	72
Ivory	71 - 63
Gray	70 - 44
Buff	70 - 40
Green	55 - 20
Tan	50 - 30
Brown	40 - 20
Red	40 - 15
Buff stone	20
Cardinal red	20
Olive green	20

Besides being useful during periods of permanent lamp failure, these portable lamps find many applications on after-dark maintenance and construction jobs.

Work-Area Lighting

The discussion up to this point has neglected work-area lighting because the equipment and principles involved resemble those for floodlighting systems. General lighting of loading platforms and delivery entrances may require a greater intensity of light but the principles of lamp location, beam overlap, and beam spread given above usually apply.

Local illumination for reading and writing must supplement floodlighting of work areas. If possible, floodlight beams should not be projected from the ground upwards to the level of the work area because severe eyestrain and confusing shadows may result. Vertical projection from above reduces shadow formation and eyestrain. Steel pipe or cable supports are most convenient for this arrangement of lights but they do not enhance the daylight appearance of the plant. Where plant design was carefully planned, delivery entrances and loading platforms are usually located away from the main entrance and floodlight support presents few problems.

One factor sometimes overlooked in work area lighting is the color of the surrounding surfaces. Black or dark-colored surfaces reflect only a small portion of the light striking them. Hence, wattage required to produce a given intensity of light is greater than when white or light-colored surfaces are used. Table 3 lists reflection factors for colors commonly employed in building materials. As can be seen, white walls will reflect the greatest proportion of light striking them. This is a good argument in favor of white-washed walls even though their upkeep may be slightly greater than that for walls which are gray or dark.

Floodlighting Calculations

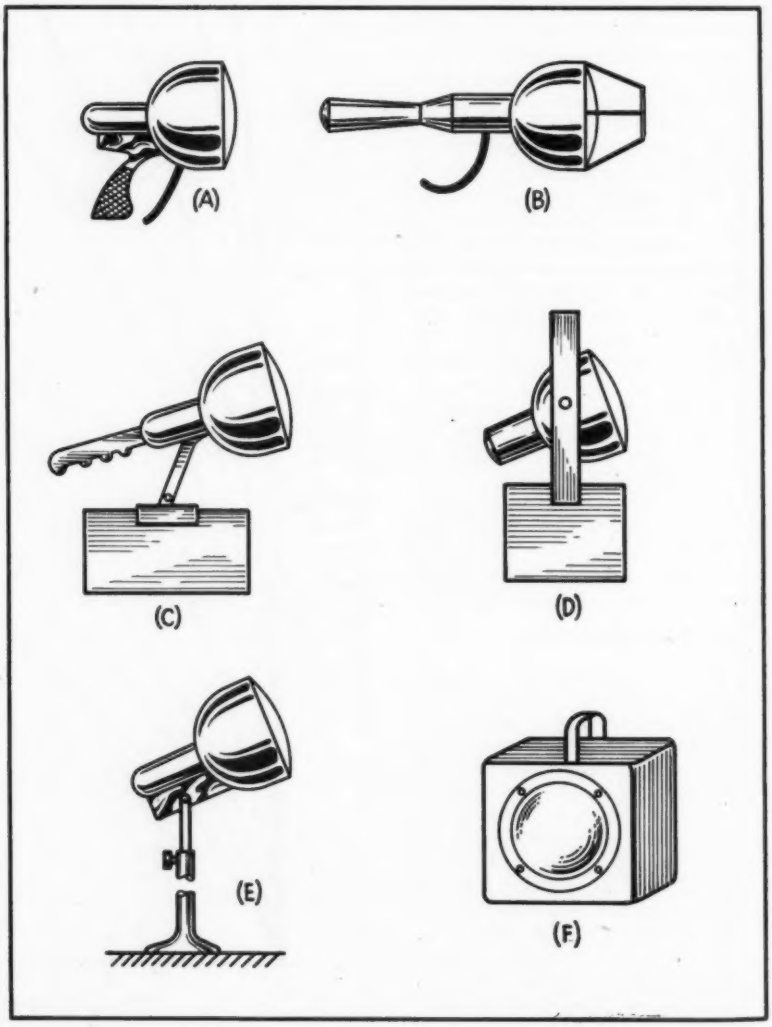
Computations for floodlamps involve only a few simple principles of lighting. To illustrate how lamp data are used, a typical industrial floodlighting problem will be solved.

Fig. 8 shows the plan and elevation of a four story industrial building whose front wall is to be illuminated by floodlamps. A study of the building length shows that at least two groups of lamps would be best for illuminating it. One group on each side of the entrance gate would provide the necessary overlapping at the center of the building and make the product name stand out against the less brightly lighted walls on each side. Total area to be lighted is 300x100 ft or, 30,000 sq ft. Assuming that the front wall is smooth-face buff brick, required intensity from Table 2 is 10 to 15 foot-candles. For illustrative purposes, an intensity of 10 foot-candles will be used, although any other value within the given range would probably produce satisfactory results. With a 10 foot-candle intensity and 30,000 sq ft wall area, total light flux required is

$$10(30{,}000) = 300{,}000 \text{ lumens.}$$

Using a 1,500 watt PS-52 general service lamp with 33,000 rated initial lumens output, corrections must be made for the average output from the lamp and for beam efficiency. Average outputs and beam efficiencies are available from lamp manufacturers but for this problem they may be taken as 82% and 47%, respectively, without

Fig. 7—Various types of portable floodlamps for emergency service: (A) Pistol grip type, (B) long handle with lens guard, (C) and (D) battery types, (E) adjustable height, (F) battle lantern



too great a deviation from actual conditions.

Actual output of the lamp will therefore be about

$$33{,}000(0.82)\ (0.47) = 12{,}700 \text{ lumens.}$$

Number of lamps required is

$$300{,}000/2{,}700 = 23.6, \text{ say } 24$$

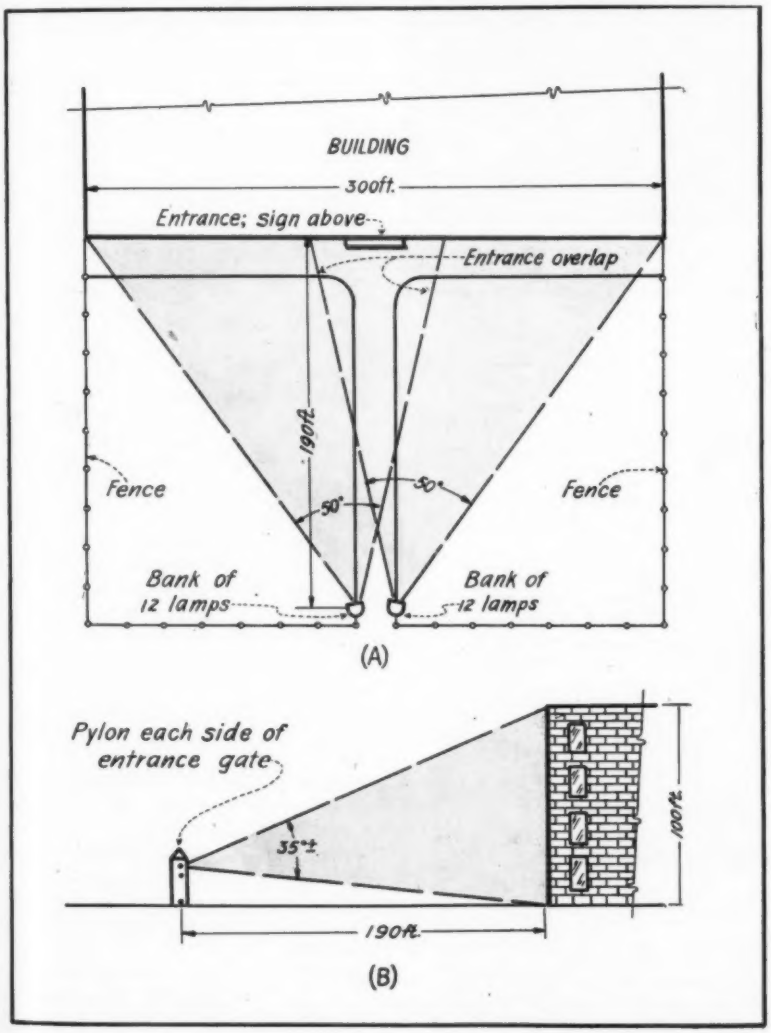
These could be conveniently split into two banks of 12 each, as shown in Fig. 8.

Exact location of each bank would depend on the beam spreads available from the lamp manufacturer. A scale layout, such as shown in Fig. 8, indicates that a 50° horizontal spread and a 35° vertical spread would be suitable if the lamps were mounted 190 ft from the building wall. Moving the lamps closer to the wall would require a larger horizontal spread to illuminate the entire building and a change of the vertical spread to prevent overshooting to the sky. Exact spread to be used will depend on the distance from plant wall to lamps. For these data manufacturers catalogs should be consulted because they provide the most accurate information available.

The calculation method given here is only an example of one type which may be used. Many manufacturers have developed tables and charts from which lamp sizes can be determined more easily and rapidly than described here. When contemplating purchase of a particular type lamp, the data applying specifically to that lamp should, of course, be used. For preliminary estimates of number of lamps required, probable location, and approximate beam spreads, the method detailed here can be used.

Once a floodlighting system has been installed it requires little attention other than routine cleaning and replacement of bulbs. Neglect of either task is inexcusable because system effectiveness is seriously impaired. Although maintenance procedures are simple, there are certain rules which can be followed to make it easier, safer, and quicker.

Fig. 8—Plan and elevation views of the plant using the floodlights selected in the problem worked out in the text of this article. The arrangement shown is only one of many possibilities



System Maintenance

Where lights are mounted high above the ground on poles, trees, or other structures, ladders adapted to the particular climbing conditions encountered should be used.

Cleaning frequency will depend on atmospheric conditions in plant locality. Dusty, gas-laden atmospheres will generally increase cleaning frequency because light intensity decreases rapidly with accumulation of thick layers of dust and dirt. Under such conditions weekly cleanings may be advisable. With clean atmospheres, bi-weekly or monthly cleanings are often satisfactory. Except under unusual conditions, light cleaning only at the time of bulb replacement is seldom satisfactory. Since many industrial floodlights are of the enclosed type, only an external cleaning is usually required. Once or twice a year the lamp can be opened and the reflector cleaned. Regardless of the purpose for which a floodlight system was installed, it should be kept clean at all times. If not, the lamps are operating at rated capacity but give less than the rated amount of light.

Bulb replacements required will not be frequent because average rated life is 1000 hours. Frequent replacement indicates that excessive vibration, voltage fluctuation, or weather conditions are affecting lamp operation. Local conditions should be investigated to see which of these three, or other factors, is reducing lamp life.

Floodlighting know-how, equipment, and methods are now at a new high. Putting light where it belongs, giving it the proper intensity, and elminating glare is an easy task to-day. The manufacturers and suppliers of equipment have made it so by their intensive studies and tests of industrial floodlighting systems. There are times when it is difficult to prove in dollars and cents the true value of a floodlighting system. However, if one is installed where the need for it actually exists, it will soon prove its true worth. Good installation and proper maintenance will enable a floodlighting system to "prove out" every time.

Acknowledgement and credit are due Hicks Associates of New York City for accumulating the data published in this article. This firm also supplied the sketches from which our illustrations were made.

CENTRAL STATION DESIGN AP

B. R. WHEELOCK, JR.
Gilbert Associates

Fig. 1—Mohn Brothers, felt hat manufacturers in Reading, Pa., had Gilbert Associates design a plant compatible with limited factory area. The equipment is complete and modern

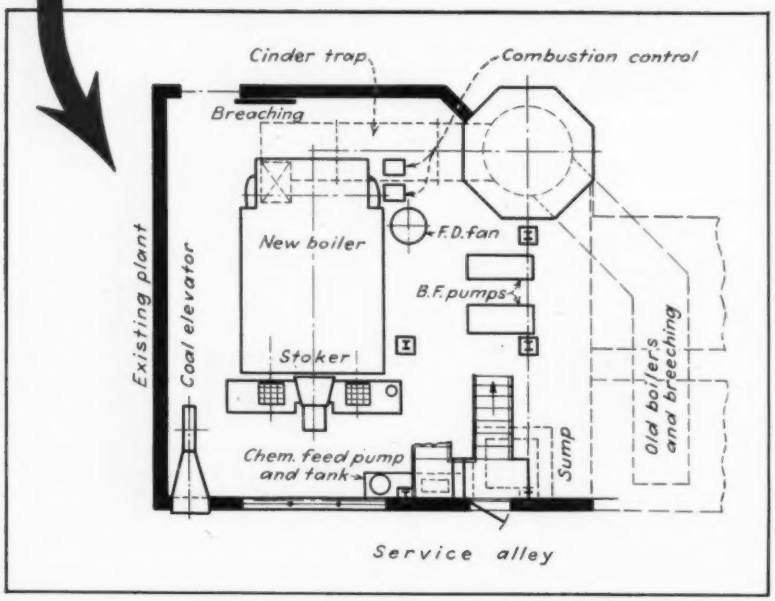


Fig. 2—Plan view of the building and equipment. The ash storage bin is on the roof, as seen in Fig. 1. Boiler is designed to produce 21,500 lb per hr at continuous rating

MOHN BOTHERS Company of Reading, Pa., has been in the hat manufacturing business since 1871, and today they are among the major producers of wool felt hat bodies in the United States. This unusual manufacturing process requires large quantities of saturated steam. The growing need for steam and the need for additional plant heating had augmented the load demand to such a point that a completely new steam generating plant was justified. The new steam plant, recently placed in operation, replaces two Heine boilers equipped with Murphy furnaces and Riley stokers, one of which was installed in 1903 and the second one in 1910.

The new plant was designed to provide (1) maximum efficiency with a minimum of operating labor and initial cost, (2) for future expansion of the steam demand, and (3) operation over a widely varying load range. After several extensive studies, preliminary layouts and cost estimates, a site was selected adjacent to the existing boilers and centrally located with respect to the major portion of the manufacturing processes. The factory is located in a densely populated residential area; hence, great precautions were taken to reduce noise and smoke nuisance to a minimum.

Construction work started with the relocation of existing manufacturing equipment from the site selected. Excavation and construction of the foundations went forward under the existing plant roof, with the removal of the roof being postponed until just before the erection of the building steel. The entire project was executed without curtailing manufacturing production.

Fig. 1 illustrates the building, which consists of structural steel framing, concrete block walls and a concrete foundation. It has a precast concrete slab roof covered with an insulated built-up roof. Standard fire-resistive construction was used throughout and included the use of steel sash, steel fire doors, steel treads and grating platforms. Some of the coal handling and ash and dust removal equipment

APPLIED TO SMALL STEAM PLANT

Felt hat manufacturer installs a modern steam plant with automatic equipment to obtain better control of processing operations and to secure a more uniform product. Preliminary studies reported here indicate a fuel saving of about 30%

may be seen located upon the roof, and in the rear, the existing stack which serves the new boiler appears. A plan view is shown in Fig. 2.

The boiler unit was designed to produce 21,500 lb per hr of 125 psig saturated steam at continuous rating. The main steam piping connects to the existing main steam header for the entire plant and has been fabricated from 6-in. A.S.T.M. Specification A53, Grade B, seamless steel pipe.

The boiler is fired with a single retort moving grate stoker, equipped with steam power ash dumping mechanisms, which appear in Fig. 9. The stoker is motor driven through a hydraulically operated drive mechanism, which varies the frequency of stroke of the constant stroke length feeding ram. A counter connected to this mechanism yields a fairly accurate estimate of the coal consumption. This stoker is designed to burn nut and slack grade of bituminous coal.

Fuel is supplied to the plant by high-lift type trucks, which chute the coal through a port appearing at the left-hand side of the building in Fig. 1 into a low level hopper adjacent to the centrifugal discharge bucket elevator, which can be seen in the background of Fig. 4. The elevator, fed from this lower hopper, conveys the coal at a maximum rate of five tons per hour into the bunker above. This bunker has a maximum active capacity of 24 tons. The coal flows from the bunker by gravity through a coal gate, visible in Fig. 4, into the stoker feeding hopper below. Coal bunker level switches operate indicating lights to show the boiler operator the level of the coal and automatically stop the coal elevator when the bunker fills to capacity.

Ash from the stoker pits is periodically, manually pulled forward through the ash removal doors onto the ash system intakes located just in front of the ash pit doors, as shown in Fig. 5. The ash falls through a sizing grating downward and is swept through the conveyor pipe line upward into the storage bin by a flow of air caused by a vacuum created at the bin inlet by steam jets directed into a venturi shaped section of the ash pipe. The ash storarge bin, as shown in Fig. 1, is conveniently located above the building roof, making it possible to periodically empty it by gravity flow into trucks, which drive through the alley below.

The new plant employs city water for make-up, subsequent to zeolite softening, and an emergency city-water line was installed. Either of which may be employed to supply make-up water to the deaerating heater which is located in an elevated position above the boiler feed pumps and appears in Fig. 7. Condensate is returned by gravity to the condensate return tank in the old section of the plant, and it is then pumped into the deaerating heater. This heater is designed to deliver 25,000 lb per hr. of deaerated feedwater at a temperature of 218° F. A horizontal storage tank has been located beneath the deaerating trays aand has a capacity of 780 gal, equivalent to 15 minutes boiler feedwater supply when the boiler is operating at its peak load.

The steam section of the deaerating heater is protected from excess pressure by means of an adjustable back pressure multiport relief valve. The heater in addition, is equipped with an overflow loop seal.

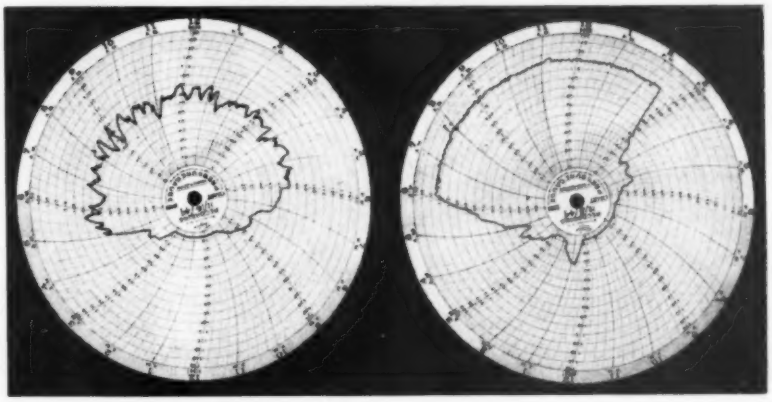
Deaeration is accomplished by steam and water following the parallel downflow principle by flowing over and down stainless steel trays. The deaerating heater is equipped with a U-tube type vent condenser through which the non-condensable gases pass prior to being vented to the atmosphere.

The boiler feed pumps, shown in Fig. 6, are located directly below the deaerating heater. A dual pump installation has been made, one of which is motor driven and the other, steam turbine driven. Either pump is capable of handling full boiler load.

Exhaust steam from the turbine drive is employed to supply low pressure steam to the heater for heating and deaerating the feedwater. Reference to Fig. 7 will reveal a pressure reducing valve, which is arranged to supply live steam to the deaerator at a reduced pressure for heating and deaerating the feedwater in the event of the use of the motor driven boiler feed pump. These boiler feed pumps are identical, each being of the centrifugal type capable of delivering 50 gpm against a 360 ft head.

Feedwater flow to the boiler is automatically controlled by means of a Copes feed water regulator actuated by the water level in the steam drum. Protection is afforded the boiler feed pumps by means of continuously flowing by-passes, which are piped back from the pump discharges to the deaerating heater. This arrangement ob-

Fig. 3—Prior to installation of new boiler, factory processing demands created wide pressure fluctuations at the steam header, as shown in chart at left. At right is pressure chart for new boiler



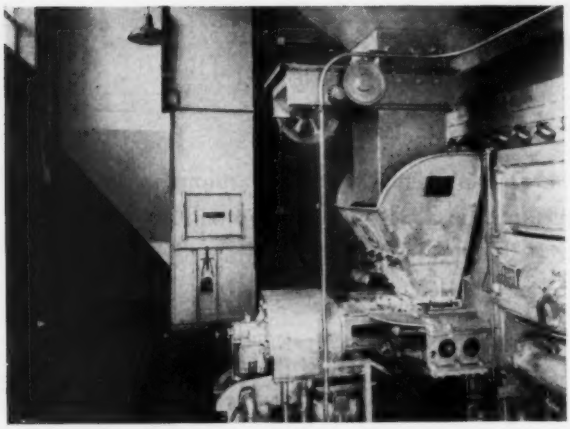


Fig. 4—The firing aisle, showing the coal hopper, and elevator, stoker mechanism, and furnace doors

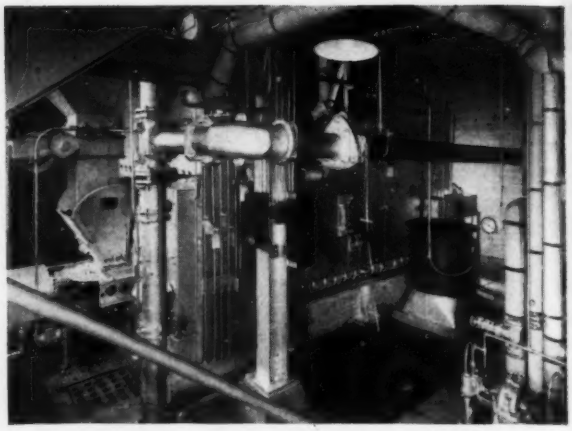


Fig. 5—FD fan, combustion controls, ash collection pipes, and manifolding drains are at right of boiler

viates the likelihood of damage occurring to the pumps when the feedwater regulating valve closes.

Forced draft for the stoker is supplied by a vertical down discharge fan, having outlet air regulating vanes. The fan, which is shown in Fig. 5, is driven by a two-speed motor, the lowest speed is sufficient to meet all demands for the present load and the highest speed is available for anticipated larger future loads. A substantial power saving is made by using the lower speed over that required by a single-speed fan drive. Air from the fan is conducted through a concrete duct located below the boiler to a plenum chamber below the stoker grates.

A mechanical type cinder trap has been located in the breeching extending to the existing 125 ft brick chimney. This cinder trap was designed to comply with the most rigid smoke abatement ordinances. Cinder collected in the hopper of this unit is conveyed to the ash storage bin through the same system as that used for the ashes. The line conveying this dust to the ash storage hopper appears in Fig. 5.

Automatic Controls

An automatic combustion control responsive to boiler outlet steam pressure automatically regulates the forced draft fan outlet vanes, the stoker coal consumption by varying the hydraulic stoker drive, and the boiler outlet damper in accordance with the fluctuations in steam demands. The combustion control equipment is shown beyond the forced draft fan in Fig. 5. This arrangement furnishes a constant steam pressure at all loads. Draft gauges have been installed to indicate the underfire, overfire and uptake draft, as shown in Fig. 10.

The boiler salines are periodically treated with injections of chemical solutions by means of a positive displacement chemical feed pump operating against boiler drum pressure and supplied with solutions from the adjacent chemical mixing tank. This equipment is clearly shown in Fig. 9. The positive feed system is protected from overload damage by means of a rupture disc, which also may be seen in Fig. 9. Both continuous and intermittant blow-off have been provided to maintain the boiler water solids at the proper level. These blow-off piping lines connect to a blow-off tank, which is vented to the atmosphere and drained to the adjacent storm sewer.

The entire plant occupies only 1200 sq ft of floor space of factory area; however, it affords convenient accessibility to all equipment. It is easily ventilated by means of the large window openings and the large ventilator in the roof.

The clean lines of this design are clearly shown in Fig. 5, which illustrates the careful method of conducting all boiler vents to a manifold prior to discharging them to waste and tagging them to illustrate to the operators the function of each valve. The steam

Fig. 8—Steam and feedwater drum; note main steam line from the boiler outlet with non-return and stop valves

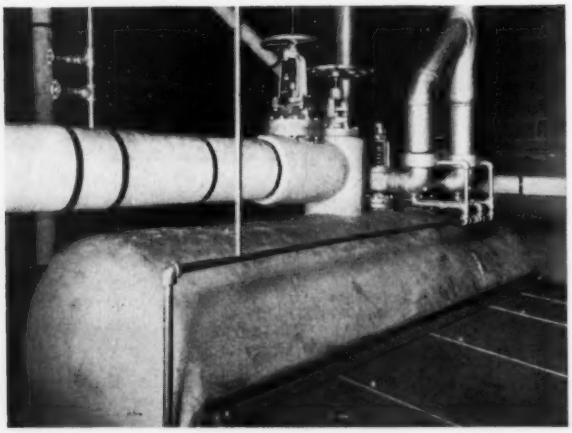
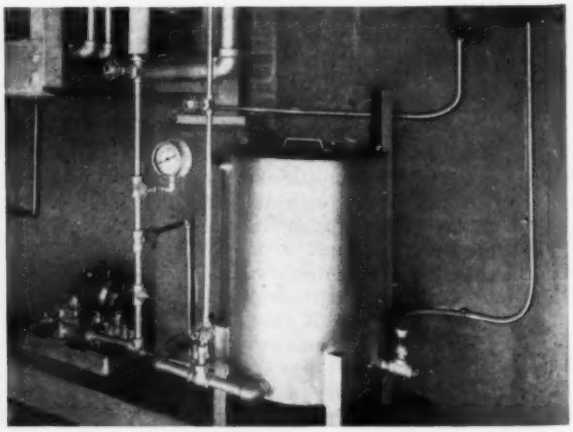


Fig. 9—Chemical pump, and mixing and solution reservoir; latter has a rupture diaphragm as over-pressure protection



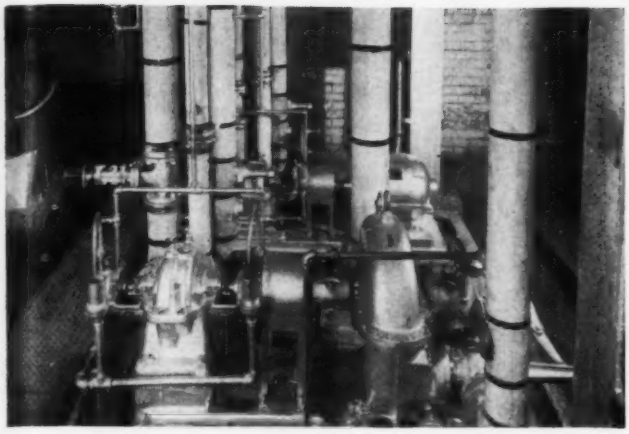


Fig. 6—One of the boiler feedwater pumps (foreground) is turbine driven, while the other one is motor driven

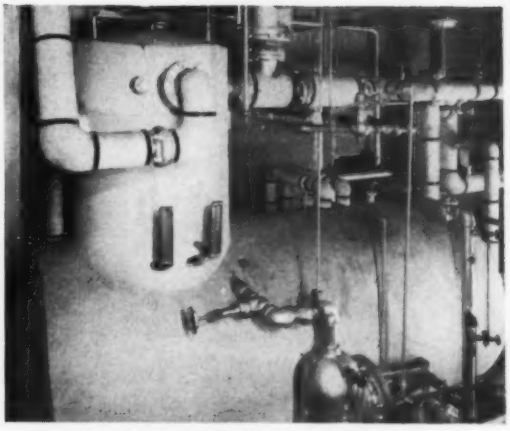


Fig. 7—Deaerating heater, vent condenser and reducing valve to maintain deaerator pressure

drum and main steam line with the associated non-return valve and stop valve, required in the state of Pennsylvania, appear in Fig. 8. There will also be noted the two safety valves, separately mounted upon individual nozzles upon the boiler drum, and their vent to atmosphere. This view also shows the coal bunker in the background. Here again, it is evident the application of central station design practice to small boiler plants is wholly feasible and results in highly satisfactory installations.

Preliminary studies and layouts, cost estimates, plans, specifications supervision of construction and purchasing were all among the engineering services provided by Gilbert Associates, Inc., of Reading, Pa., for this project. The design features of this plant indicate successful application of big central station engineering to the smaller plant needs of industry.

Preliminary operational studies of this plant indicate a fuel saving of at least 30% of the quantity of coal, which would have been consumed by the existing "old" boiler units to produce the same amount of steam. Not only are these large fuel savings being experienced, but steam is being produced at a constant pressure which was not formerly experienced, resulting in a better control of manufacturing processes and a more uniform product. The charts reproduced in Fig. 3 illustrate the elimination of the steam header fluctuations which resulted from placing the new unit in service. The largely automatic operation of the new boiler equipment furnishes a saving in boiler room manual labor.

Fuel Saving 30%

The steam load is a function of the production load plus the factory heating demand, and at night when the manufacturing demand for steam drops to zero, the stoker is banked. All operation at this time is manually regulated and a 5 psi. steam header pressure is sufficient. The unit rapidly comes up to load in the morning. The new plant has been found to be easy to operate, clean, quiet and economical.

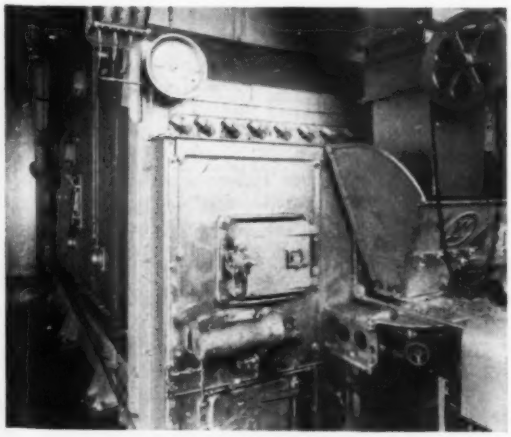
Outstanding features of this plant are here summarized:

This boiler unit is designed to produce 21,500 lb per hr of 125 psig saturated steam at continuous rating.

The deaerating heater is designed to deliver 25,000 lb per hr of deaerated feed water at a temperature of 218°F. The steam section is protected from excess back pressure by a multiport relief valve.

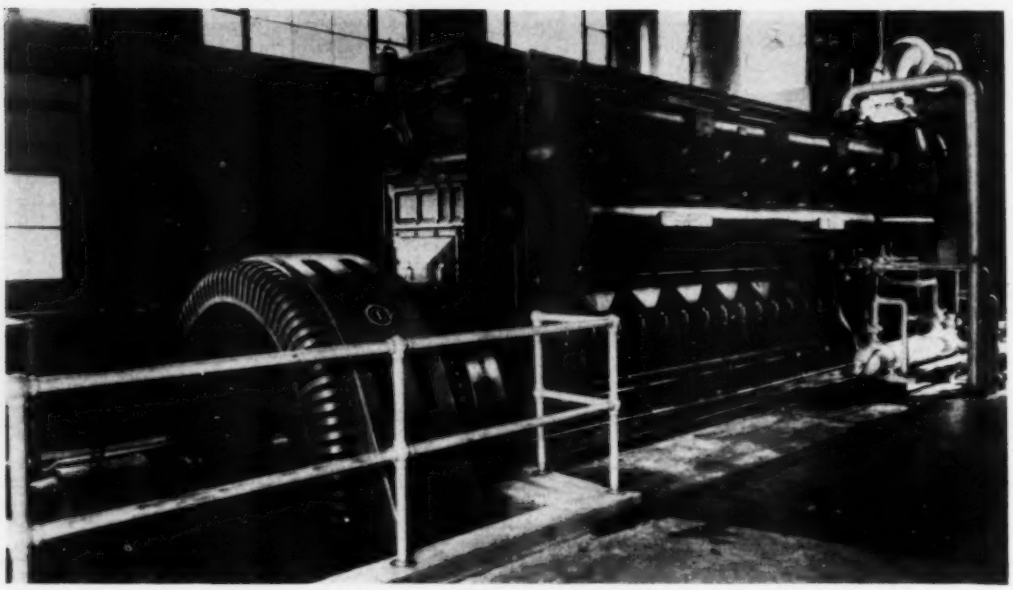
Automatic combustion control responsive to boiler outlet steam pressure automatically regulates the forced draft fan outlet vanes, the stoker coal consumption by varying the hydraulic stoker drive, and the boiler outlet damper in accordance with the fluctuations in steam demand in the plant.

Fig. 10—Left side of boiler showing pressure and draft gauges, soot blower, stoker dead-plate



MOHN BROTHERS STEAM PLANT — PRINCIPAL EQUIPMENT

Boiler, integral-furnace type	Babcock & Wilcox, Inc.
Stoker	Westinghouse Electric Corp.
Deaerating heater	Cochrane Corp.
Boiler feed-pump turbine	Terry Steam Turbine Co.
Boiler feed pumps	Pennsylvania Pump & Compressor Co.
Coal elevator	Link-Belt Co.
Ash conveyor and storage tank	United Conveyor Corp.
Combustion control	Brooks Engineering Co.
Cinder trap	Green Fuel Economizer Co.
Forced draft fan	L. J. Wing Manufacturing Co.
Chemical feed pump and mixing tank	Milton Roy Co.
Condensate return pump	Ingersoll-Rand Co.
Draft gauges	Republic Flow Meters Co.
Feedwater regulator	Northern Equipment Co.



Flexible service lines and cork foundations make the plants vibration free

DIESELS THAT MEET EMERGENCIES OF LIMITED HYDRO POWER . . . .

DIESEL-ELECTRIC power units of 1000-kw. capacity at Houlton, Maine, and in two hydro-electric plants in the same general area in northern Maine have solved a problem of maintaining dependable power service where hydro-electric plants are now proving inadequate and the water supply must be conserved. The solution was a cooperative program sponsored by the city of Houlton.

Although diesel power units had long been considered essential in solving the problem of filling out growing power requirements, it took a drought crisis during the winter of 1947-48 to bring action. At that time residential consumers in the area were receiving only one-third of the power that they needed. Temporary and partial relief was obtained from two U. S. Navy destroyer escort vessels.

The first of three 1440-hp turbo-supercharged diesel powered units was installed on Jan. 24, 1948, at the Caribou power plant of the Maine Public Service system. (See "Caribou Diesel Plant Built in a Hurry" February 1950 I & P) The operating record of this Caribou diesel was largely responsible for the selection of duplicate units at Houlton, Me., and Tinker, New Brunswick, the following year. All three engines are 4-cycle, supercharged diesels with eight cylinders of 14½-in. bore and 20-in. stroke, and each developing 1440 hp at 360 rpm.

By the end of January the Caribou engine and generator had supplied 108,160 kwh. In February it produced 629,800 kwh and by the end of 1948 it had produced 3,528,540 kwh. During most of this period the plant was under construction and operating conditions were difficult. As a consequence no figures on fuel consumption were available for the first few high-production months, but during the remainder of 1948 the engine produced 12.54 kwh per gal of fuel. During the first four months of 1949, the efficiency rose to 13.37 kwh per gal, as computed from 706,800 kwh from 52,848 gal of fuel.

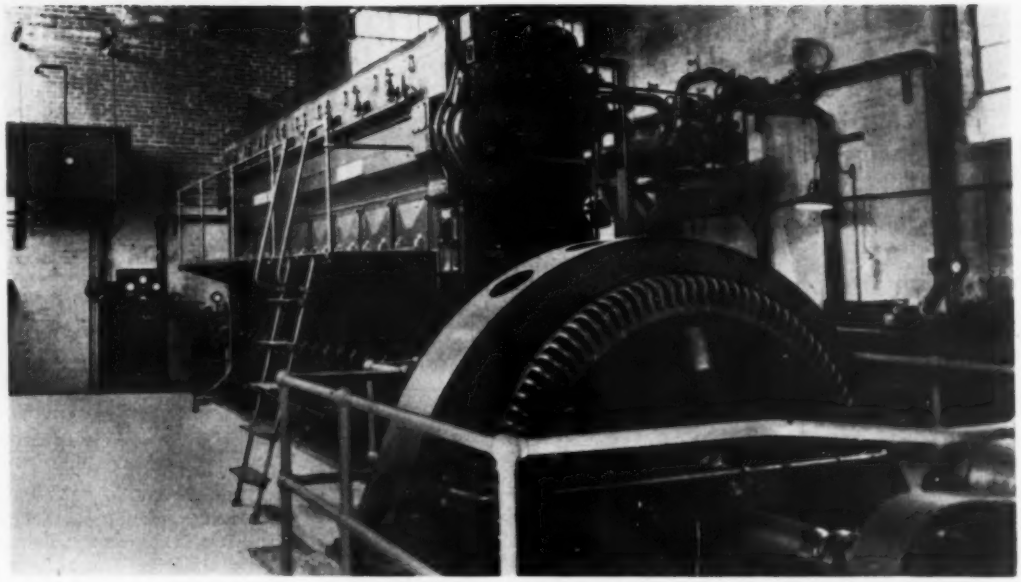
The 1948 performance was a leading factor in the decision of Maine Public Service and Houlton engineers to install an identical unit. The cooperative venture of the city of Houlton and Maine Public Service gave this city of 8000 people a power unit that is capable of carrying the city's entire normal residential load.

As a part of the emergency power program of Maine Public Service, the Houlton Water Co. agreed to finance and build a diesel plant to be operated, maintained and eventually purchased by Maine Public Service. Houlton issued $170,000 in bonds to purchase equipment and construct the plant. Maine Public Service is paying off principal and interest over a 10-year period. Houlton retains title to the plant until paid off and has an option to repurchase it at the end of 10 years at cost less depreciation.

During the break-in period of four months after installation Jan 15, 1949, the Houlton diesel plant was operated only a moderate amount but demonstrated a high efficiency of 13.23 kwh per gal of fuel by generating 166,200 kwh on 12,559 gal of fuel.

The latest step in developing drought-proof power supply for the region was installation of another 1440-hp supercharged diesel at Tinker, New Brunswick, by the New Brunswick Electrical Power Co., Ltd., an operating subsidiary of Maine Public Service. The diesel plant was added to the big hydro plant there and was put on the line March 2, 1949. By the end of April, it had produced 64,000 kwh. While under this load it is significant to note that only 4440 gal of fuel were consumed, giving an average of 14.41 kwh per gal.

Accessory equipment and the handling of fuel, lubricating oils and cooling water for the three diesels are similar, with only such differences as were necessitated by varying conditions in the three plants. Each engine drives



Diesel engine, placed on line at Houlton, returned 13.23 kwhr per gal of fuel

• • • are capable of carrying the entire normal residential load at Houlton, Me.

directly a 1250 kva, 1000 kw generator producing 3-phase, 60-cycle current. At Tinker and Houlton, the generators are connected directly to the 4100-volt transmission system.

The hydro stations had convenient sources of cooling water. Raw water is drawn from the river and put through heat exchangers. Separate motor-driven centrifugals for each engine circulate soft water through the exchanger and engine jackets.

At Houlton, since no economical supply of raw water is available, a dual radiator cooling system is provided on the plant roof. Maine winter weather required putting 200 gal of antifreeze in the system. A 550-gpm centrifugal pump driven by a 15-hp motor supplies soft water through the radiators and engine jackets. Engine water temperature is kept at the specified point by means of a thermostatic regulating valve for by-passing the radiator.

All of the engines use No 2 diesel fuel. Both the Tinker and Houlton plants can unload fuel from tank cars by gravity from railroad tracks on high embankments. The Tinker plant has two 10,000-imperial-gal storage tanks and the Houlton plant has one 25,000-gal tank.

Engine capacity and economy are greatly increased by a turbo-charger driven by engine exhaust gases. Air for each diesel is drawn through a 4-element viscous impingement-type filter. Exhaust gases vent through vertical silencers.

Engine bearings and cylinders are pressure lubricated by means of a built-in pump. A motor-driven auxiliary pump is arranged to cut in automatically if engine lube pressure drops. The auxiliary also is used before starting and after stopping the engine.

Operating procedure is facilitated and efficiency is increased by means of a control panel near each engine with push-button switches for auxiliary equipment, pressure gages, exhaust pyrometer, and an automatic shutdown for low lube pressures and overspeed. Also, an alarm warns against high jacket water temperature.

PRINCIPAL EQUIPMENT IN THE PUBLIC SERVICE DIESEL STATIONS AT TINKER, HOULTON AND CARIBOU

Diesel Engines	The National Supply Co., Superior Engine Div.
Turbochargers	The Elliott Co.
Generators:	
At Tinker	General Electric Co.
At Houlton & Caribou	Ideal Electric & Mfg. Co.
Air Compressors:	
At Tinker & Houlton	Quincy Compressor Co.
At Caribou	Gardner-Denver Co.
Cooling water pumps:	
At Tinker & Houlton	Yeomans Brothers Co.
At Caribou	Ingersoll Rand Co.
Radiators:	
At Houlton	Young Radiator Co.
Heat exchanger	Graham Mfg., Co.
Water strainer:	
At Tinker	The Elliott Co.
Governors	Woodward Governor Co.
Fuel oil meters	Neptune Meter Co.
Fuel filters:	
At Tinker & Houlton	Purolator Products, Inc.
At Caribou	Wm. W. Nugent & Co., Inc.
Air filters	Air Maze Corp.
Silencers	The Maxim Silencer Co.
Auxiliary lube pumps:	
At Tinker & Houlton	Geo. D. Roper Corp.
At Caribou	Blackmer Pump Co.
Lube oil strainers	Purolator Products, Inc.
Lube oil coolers:	
At Tinker & Houlton	Graham Mfg., Co.
At Caribou	Struthers-Wells Corp.
Temperature regulators:	
At Caribou & Tinker	Fulton-Sylphon Div., Robertshaw-Fulton Controls Co.
Pyrometer	Illinois Testing Laboratories, Inc.
Control and alarm panels	The National Supply Co.
Switchboard:	
At Houlton	Northeastern Engineering Co.
At Caribou	I-T-E Circuit Breaker Co.
Battery system	The Electric Storage Battery Co.
Vibration control	The Korfund Co., Inc.

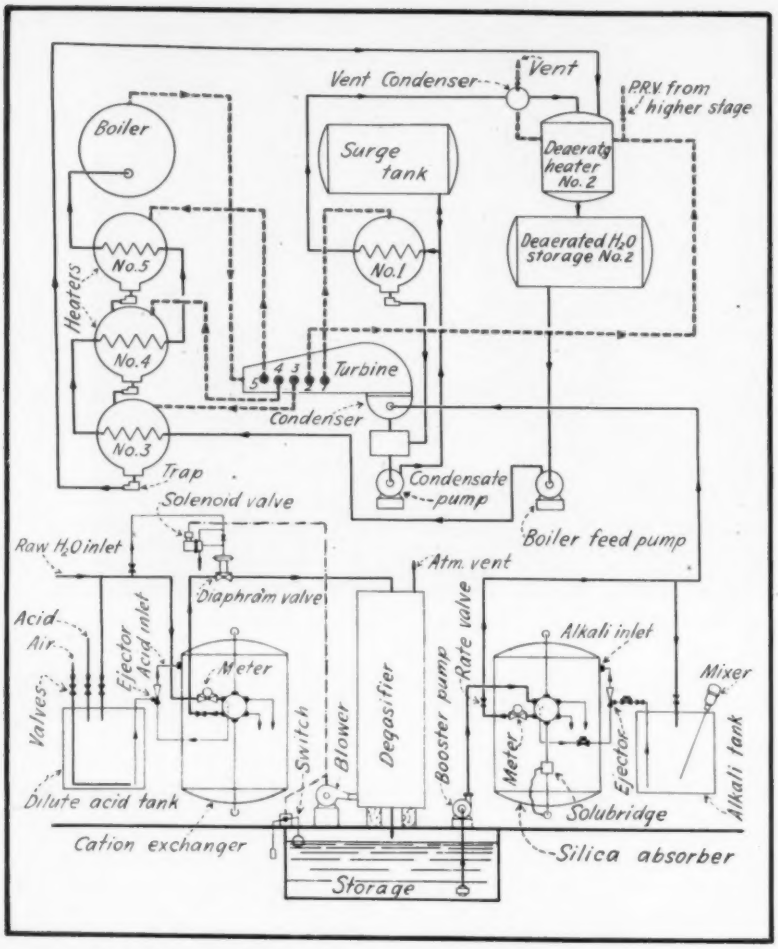


Fig. 1—Water passes through cation remover, degasifier and finally a combined anion and silica absorbing unit

DESIGNERS and operators of public utility power plants appreciate the importance of good boiler feedwater. Their plants are operated so as to require a minimum amount of makeup, commonly not to exceed 1 to 3%, which for more than twenty years has usually been evaporated.

As early as April 26, 1915, (1) the Detroit Edison Company, installed an evaporator at its Connors Creek Station to distill the makeup. Live steam, at 225 psi and 200° F superheat, was delivered to the evaporator coils. Vapor from the evaporator was mixed with exhaust from auxiliaries and condensed in a barometric condenser. Condensing water came from the main condenser.

On November 20, 1916, the Buffalo-Niagara Electric Company (2) put its Riverside Station in operation with a two-effect evaporator for makeup. The first-effect unit received live steam at 275 psi and 275° F superheat. Vapor and drips from the first-effect were delivered to the coils of the second-effect evaporator. Vapor from the second-effect and drips from the coils passed through surface condensers through which condensate from the main condensers was pumped on its way to the feedwater heater. The condensed vapor was delivered to a distilled water storage tank from which it was fed to the feedwater as required.

The West Penn Power Company, (3) Springdale Station, installed an evaporator on July 19, 1920, which received exhaust steam from the house turbine and delivered the heat of the vapor to condensate from the main

DEMINERALIZATION VERSUS EVAPORATED MAKEUP FOR CONDENSING POWER PLANTS

J. D. YODER, Vice President, The Permutit Company

Complete demineralization of water — removal of all dissolved solids to make a product as good as distilled water — has certain advantages over evaporators for distilling low percentages of boiler feedwater makeup. It may be used without degrading heat and resulting energy loss. The method and its advantages, as well as its first use in a plant, are discussed in this authoritative article

condensers. This substantially reduced the energy loss as compared with the use of live steam in the evaporator coils.

In December, 1923, the Consumers Power Company (4) installed two 20,000-kw extraction turbines and two 7400-lb-per-hour evaporators in its Saginaw River Station. Each evaporator received extracted steam from the eighth stage of the turbine at 19 psia and the vapor was condensed in a heater receiving extracted steam from the eleventh turbine stage at 5 psia.

This insertion of the makeup evaporator between two successive extraction points of the turbine is typical of what has been the usual practice for power stations designed since 1923. Sometimes, evaporator condensers are installed to condense the vapor and to reduce the energy loss.

Early Arrangements

All four of the early arrangements tied the makeup evaporator into the feed cycle and recovered all the Btu of the evaporating process except the heat lost in blowing off the evaporators. There was a substantial energy loss, nevertheless, from degrading heat in the evaporator coils to a lower pressure. The utilization of exhaust steam in the coils, as was done by West Penn Power Company, reduced the energy loss. Placing the evaporator between two extraction points of the turbine, as done by Consumers Power Company, still further reduced the energy loss.

This method of using an evaporator was highly efficient as demonstrated by its general application during the past 25 years. It still causes an appreciable energy loss and affords an opportunity for improving economy by preparing makeup water in such a manner as to permit using the full availability of heat for conversion to energy.

Formerly, in the opinions of most designing and operating engineers, the art of feedwater treatment had not been sufficiently advanced to make water treatment practical for a small percentage of makeup. But recent improvements make it possible to produce a demineralized water with substantially the same constituency as condensate from a commercial evaporator. And demineralized water may be used for makeup, without degrading heat, so that energy loss on this account may be avoided.

Fig. 1 illustrates equipment for demineralizing a clarified Lake Michigan water. Water first passes through a cation remover then through a degasifier for CO_2 removal and finally through a combined anion and silica absorbing unit. The demineralized water's analysis is given in Table 1. Not only are substantially all the mineral solids removed, but the water has practically no free CO_2 and its pH is approximately 8.0. As indicated by Fig. 1, this water can be delivered directly to the surface condenser so most of the oxygen is removed and the effluent from the hot well should not have more than about 0.03 cc oxygen per liter. Such water is suitable for passing through No. 1 low-pressure heater, from where it enters the deaerator for complete oxygen removal.

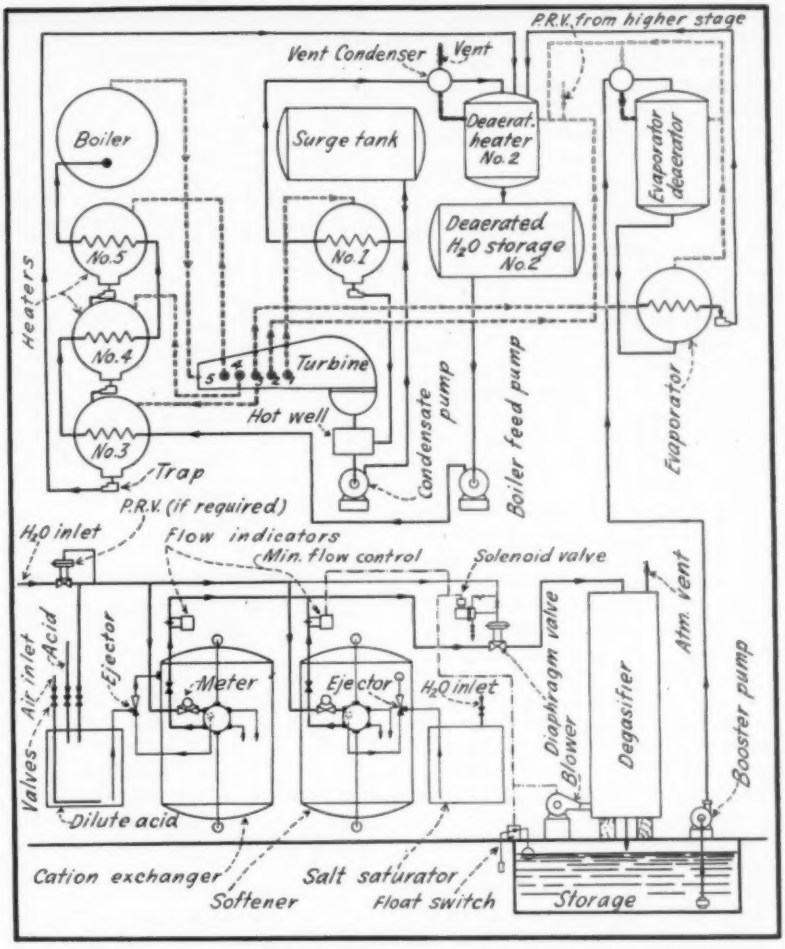


Fig. 2—Deaerator operating on extraction point 2 shown in Fig. 1, with steam supplied to evaporators from point 3

Steam Supply

The deaerator is supplied with steam from a turbine stage where the pressure is nearly always above atmospheric. If the deaerator pressure falls below atmospheric, it is necessary to remove the non-condensible gases by an air ejector. If an air ejector is not used, and if, at light turbine load the pressure falls below atmospheric, higher steam pressure must be admitted automatically through a pressure-reducing valve from a higher turbine stage. The arrangement in Fig. 1 does not use an air ejector for removing non-condensible gases from the deaerator but higher pressure steam is admitted through a pressure-reducing valve to keep the deaerator pressure above atmospheric.

Fig. 2 shows the deaerator operating at the pressure extraction point No. 2, the same as in Fig. 1, and the steam supplied to the evaporator coils is taken from the next higher pressure stage extraction point No. 3. Vapor and drips from the evaporator are delivered to the deaerating heater, which increases the amount of steam extracted from the third extraction point and correspondingly decreases the steam extracted from the second point. As the water enters the evaporator through an evaporator deaerator, vapor from the evaporator is free of oxygen and, therefore, is suitable for deaerating water in heater No. 2.

Makeup water fed to the evaporator is a mixture of hydrogen and sodium Zeo-Karb softened water which protects the evaporator from scale and holds the amount of CO_2 that goes off

with the vapor to a relatively low figure. Unfortunately, not all the CO_2 is removed for this would require deaeration in an acid condition. The hydrogen and sodium Zeo-Karb softeners reduce the alkalinity to a very low figure.

Fig. 3 is a typical heat balance when demineralizing the makeup and when using a 40,000-kw turbine with five feedwater extraction points in accord with approved standards of ASME-AIEE for a 1250-psia turbine (5). The heat balances (Fig. 3 and 4) used in determining relative power efficiencies were based upon the use of a 40,000-kw, 1250-psia turbine with ASME and AIEE approved standards for extraction pressures, so as to make these cycles most generally applicable to modern practice.

The kilowatt capacities were computed on the basis of supplying steam of the same quantity and characteristics to the throttle, and holding the same exhaust pressure for all conditions. Each heat balance was further computed on the basis of using 1% makeup at a temperature of 50° F.

In this study certain performance estimates were made and these were the same for all feed cycles. Most of the performance estimates are specified on each heat balance such as steam conditions at the turbine throttle, extraction pressures, extraction-pressure losses from turbine stage to heaters, turbine exhaust pressure, steam and water losses from boiler and evaporator and terminal temperature differences of the stage heaters.

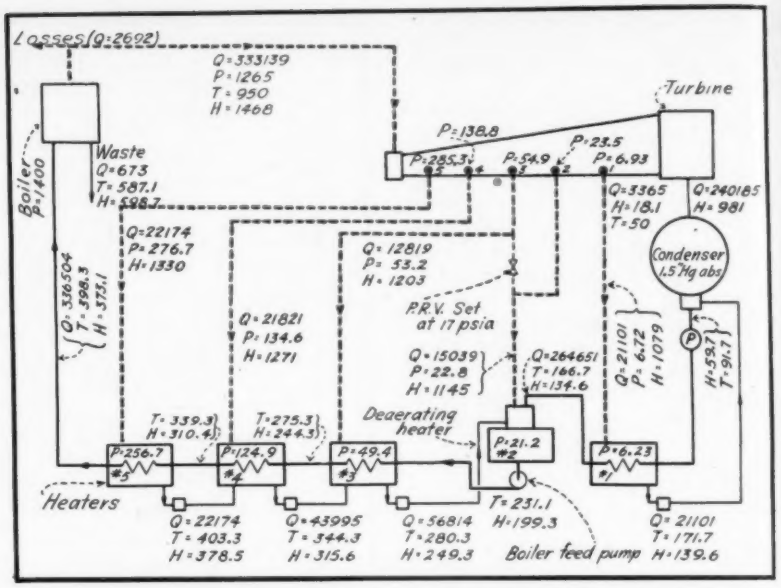


Fig. 3—Heat balance with demineralized makeup delivered directly to the surface condenser of a 40,000-kw turbine generator

Other performance estimates not shown on the heat balances are:

1. Mechanical and electrical losses, 3.0% of gross power generation.
2. Internal efficiency of turbine 85%.
3. Turbine exhaust losses 2.60% as given by Warren and Knowlton (6).

TABLE I—ANALYSIS OF RAW AND TREATED LAKE MICHIGAN WATER

		Parts per million (ppm)					
CATIONS		1	2	3	4	5	6
Calcium	Ca as $CaCO_3$	82	0.1	0	0	0	0
Magnesium	Mg as $CaCO_3$	41	0.1	0	0	0	0
Sodium	Na as $CaCO_3$	27	2.0	10	20	137	163
Total Cations		150	2.2	10	20	137	163
ANIONS							
Bicarbonate	HCO_3 as $CaCO_3$	113	1.5	0	0	0	0
Carbonate	CO_3 as $CaCO_3$	0	0	0	0	0	0
Hydroxide	OH as $CaCO_3$	0	0	6	12	50	50
Phosphate	PO_4 as $CaCO_3$	0	0	0	0	40	40
Chloride	Cl as $CaCO_3$	7	0.5	3	6	42	42
Sulfate	SO_4 as $CaCO_3$	30	0.2	1	2	5	31
Total Anions		150	2.2	10	20	137	163
Carbon Dioxide	CO_2 as CO_2	4	0	0	0	0	0
Silica	SiO_2 as SiO_2	3	0.2	1.0	2	2	4
Turbidity		0	0	1.0	2	2	10
Total Solids		157	2.4	12.0	24	141	177

		Chemical treatment for demineralization			
		ppm	c/lb	$/million lb	c/1000 gal
Sulphuric Acid	H_2SO_4—96%	312	0.9	2.80	
Caustic Soda	NaOH	270	2.5	6.75	
Total				9.55	7.95

Cost of chemical treatment within the boiler is not considered.

1. Raw Lake Michigan water.
2. Demineralized water.
3. Boiler water, 1% makeup, 0.2% blowoff with no contamination of condensate and no internal chemical treatment.
4. Boiler water, 2% makeup, 0.2% blowoff with no contamination of condensate and no internal chemical treatment.
5. Concentrated boiler water with 2% makeup, 0.2% blowoff with Na_2HPO_4, NaOH and NaCl to prevent scale and no sodium sulphite nor contamination of condensate.
6. Typical concentrated water of a 1400-psi boiler operating with surface condensate, evaporated makeup and internal chemical treatment to prevent scale, and no sodium sulphite.

Fig. 3 shows the demineralized makeup delivered directly to the condenser at 1½ in. mercury pressure. With this feed cycle the generator will deliver 40,000 kw with 333,139 lb per hour of steam at 1265 psia and 950° F.

Fig. 4 is a typical heat balance with the evaporator receiving steam from the third extraction point and delivering vapor and drips to deaerating heater No. 2. The effect of placing the evaporator in this position tends to increase the amount of steam extracted from the third bleed point and decreases the steam removed from the second bleed point. This represents a power loss, in that all of the steam delivered to the evaporator has its pressure degraded to the lower pressure of the second extraction point.

With this cycle the generator delivers 39,936 kw, which represents a power loss of 64 kw as compared with using demineralized makeup. This energy loss is based upon a makeup requirement of 1% of boiler feed. If the makeup requirement were 2%, power loss would be about twice this amount, or 128 kw.

If the difference in pressure between the second and third bleed points is insufficient to evaporate the required makeup, the steam may be delivered to the evaporator coils from point No. 4. Pressure loss between points 2 and 4 is 111.8 psi as compared with 30.4 psi between the second and third extraction points. In this case generator output is 39,873 kw, which represents a loss of 129 kw for 1% makeup.

For comparison, steam was extracted from the fifth point for evaporator

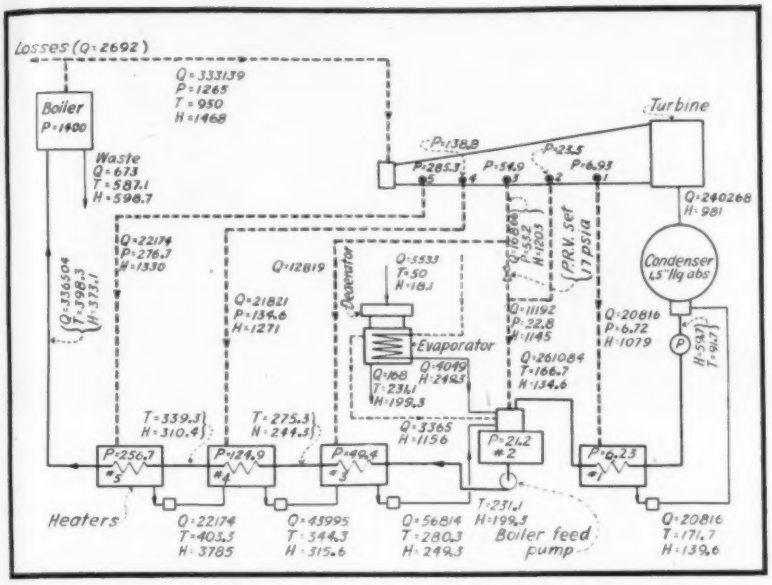


Fig. 4—Heat balance with the evaporator receiving steam from third extraction point and delivering drips to deaerator No. 2

coils and, as before, the vapor and drips from the evaporator were discharged to heater No. 2. This gave a degradation of steam pressure of 253.9 psi and a power loss of 187 kw.

Extracting steam from points 3, 4 and 5 gives three different pressure drops between extraction points and deaerating heater. If the energy losses are plotted in relation to enthalpy degradation, they determine a straight line curve, Fig. 5. The curve gives a convenient measure of energy loss, if the enthalpies of the extracted steam at the inlet to the evaporator coils and deaerating heater are known. Likewise, if the steam characteristics at the throttle are the same as used in these feed cycles, energy loss may be approximated by using the pressures at the appropriate extraction points.

With different steam characteristics at the throttle, the energy losses may be more closely estimated from the curve by using only the enthalpy degradations.

Fig. 5 gives energy losses per 1000 lb makeup, so the curve may be applied regardless of whether makeup is 1% or 2%. Essential requirements are accordingly, first, to determine the amount of makeup water required and then apply the curve for the amount of makeup and the known enthalpy degradation.

It is recognized that the energy loss when using an evaporator for makeup, can be reduced by using evaporator condenser and drain cooler, but this adds to the complication and cost of evaporating equipment and is not ordinarily done for the average sized plant. While the use of evaporator condensers and drain coolers does not eliminate energy loss it may reduce the loss by about 50%.

If makeup demand is greater than can be provided by placing the evaporator between high- and lower-pressure stages of the turbines, as may result from supplying steam to process, and if the makeup is to be supplied by an evaporator, it is common practice to supply exhaust or extracted steam to evaporator coils and send the vapor at a lower pressure to process. The energy losses for this method of operation are discussed by Yoder, Webb and Baumeister (7).

Table 1 compares boiler water conditions when demineralizing makeup from Lake Michigan with conditions when using evaporated makeup. Column 2 gives analysis of demineralized water, a product comparable to distillate from evaporators, which is frequently guaranteed to contain not more than 4 ppm total solids. The heat balances discussed were all based upon 1% makeup of which 0.8% represents loss of steam and 0.2% loss of water from the boiler. With this amount of blowoff solids in the makeup will be concentrated 5 times in the boiler if the remainder of the boiler feed is pure condensate.

Column 3 represents boiler water with this concentration when using demineralized makeup and assumes that all condensate from surface condensers is pure or free from raw water contamination and that no chemicals are fed to the boilers. This is not a practically obtainable condition for there is always the likelihood of some contamination and chemicals are normally fed to the boiler to protect against scale. The analysis, column 3, is important, however, because it shows how few solids are concentrated within the boiler when using demineralized water with 1% makeup and 0.2% boiler blowoff. Solids resulting from raw water leakage in surface condensers and chemical treatment will apply equally well when makeup is evaporated or demineralized.

Column 4 gives total solids if makeup were as much as 2% and blowoff still remained at 0.2%. This produces

(*Continued on page* 000)

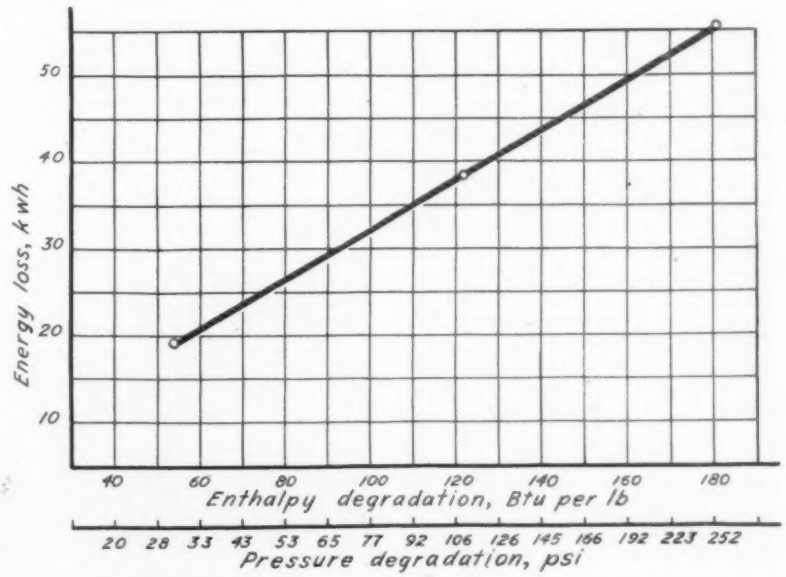
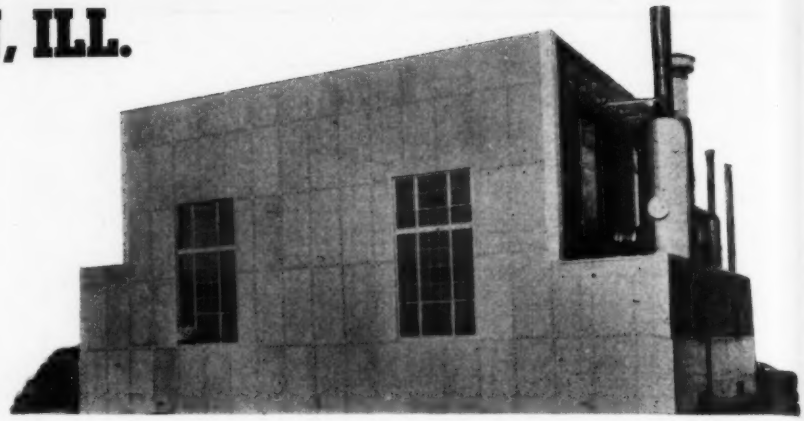


Fig. 5—Energy loss plotted against enthalpy degradation is a straight-line

BLOOMINGTON, ILL. INCREASES ITS DIESEL CAPACITY



Diesel generating plant — placed into service in 1932 — has increased its output to over 7,100,000 kwh in the first eleven months of operation during 1949

GLENN C. BOYER, Professional Engineer

IN 1932 a diesel engine generating station was built by the city of Bloomington, Ill., on an old water works site and at that time three 750 bhp units were installed. A fourth unit of 750 bhp capacity, was added in 1940. The latest addition to the plant is a 2,800 bhp diesel engine placed in operation on November 23, 1949.

There are many interesting features in this latest addition to Bloomington's utility plant. The new engine is a 7-cylinder, 21½ in. bore x 29 in. stroke, two stroke cycle, 225 rpm, blower scavenged diesel equipped with individual fuel pumps for each cylinder. Timed, force-feed lubrication is provided at six points on each cylinder. A governor controls engine speed. The scavenging blower is driven directly from the engine crankshaft.

Engine controls are centered on a self supporting cubicle, and cooling water, lube oil, fuel oil, and starting-air pressure, as well as exhaust gas temperature, may be read. The starting switches also are located in this cubicle for the auxiliary lube oil pump, jacket water pump, raw water pump, and barring-gear motor.

Generator capacity is 1,980 kw at 0.8 pf, and it is wound for operation at either 4,160 or 2,400 v, three-phase, 60-cycle. The necessary flywheel effect is incorporated in a flywheel located between the engine and generator. Excitation for the unit is furnished by a 25 kw, shunt wound, belt driven, d-c unit, operating at 125 and 1150 rpm.

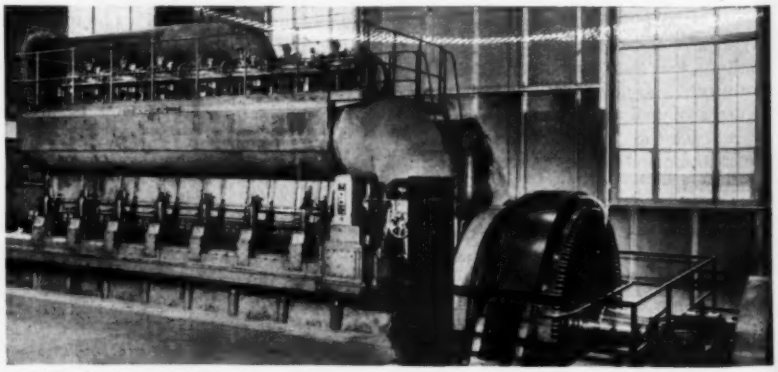
All auxiliary equipment for engine operation is located in the basement. It consists of a starting air tank and motor-driven starting-air compressor,

For three-quarters of a century Bloomington, Ill., has supplied water to its citizens. For 50 years it has been in the electrical power business. Today, it is furnishing all the water, lighting all the streets, and suppling electricity to a limited number of commercial and residential consumers.

When the city enlarged its water works installation in 1909, electrically operated pumping equipment was installed to replace the previously operated steam units. Bloomington then established the policy of generating the electricity needed for its own needs.

For the next 20 years, the city supplied water and street lighting service from the original water works site. However, in 1929 it became necessary to find a new water supply, and because the city did not possess the bonding power required to finance the water improvements, a private water company was formed to finance and build the necessary facilities. The local power company offered to sell power at the dam site, and in return take power from the city's plant in Bloomington. However, the public service commission denied the water company permission to build the transmission line. As a result of this incident, the city started active competition for electrical business in 1930

Fifth diesel unit to be placed on line develops 2,800 bhp when operated at 225 rpm. Generator is wound for 4160/2400 volt, three phase, 60 cycle current



lube oil filter, auxiliary lube oil pump, duplex lube oil and fuel-oil strainers, shell-and-tube lube oil and jacket-water coolers, raw-water pump, jacket-water pump, and emergency cooling-water pump. The latter pump is arranged for either raw or jacket-water service.

Intake air is filtered by a 16-20 x 20-in. stationary filter cells before it is passed through an intake-air muffler. An exhaust muffler also is used. Hot water heating coils are installed in the muffler. From this system sufficient hot water is supplied to heat the building.

Considerable care has been taken in planning the piping systems for fuel and lube oil, cooling water, and starting air to insure accessibility and ease of operation and maintenance. All piping is welded. A color scheme has been employed for painting all piping to aid the staff in operating procedures.

Engine jacket water is cooled in a closed system by means of shell and tube type heat exchangers. Lube oil is cooled in a heat exchanger with raw water.

Fuel oil is stored in four tanks, having a total capacity of 152,000 gal. Fuel is delivered by railroad tankcar to a spur located on the plant site and pumped to tank storage. A 10,000 gal lube oil storage also is provided.

The new unit is housed in a 39 ft x 77 ft addition to the power plant building, originally constructed in 1932. The floor arrangement provides for a shaft centerline spacing of 22 ft 6 in. between the latest unit and the next engine to be installed. The building is 33 ft in height, above the operating floor. Basement depth is 10 ft 6 in., at the engine end of the unit, and nine ft along the engine foundation and the generator end of the unit. The substructure is of reinforced concrete, while the superstructure is brick and steel frame. The south wall of the addition is faced with flat transite sheets to facilitate plant extension at a later date. A chain hoist with travelling dolly hung from a roof beam on the centerline of the unit facilitates engine maintenance.

Switchgear installed with the new generating unit provides control facilities for the generating unit and five feeders. An over-head cable connection is installed between the bus of the original gear and the new installation since the two switchgear sections are located some distance apart.

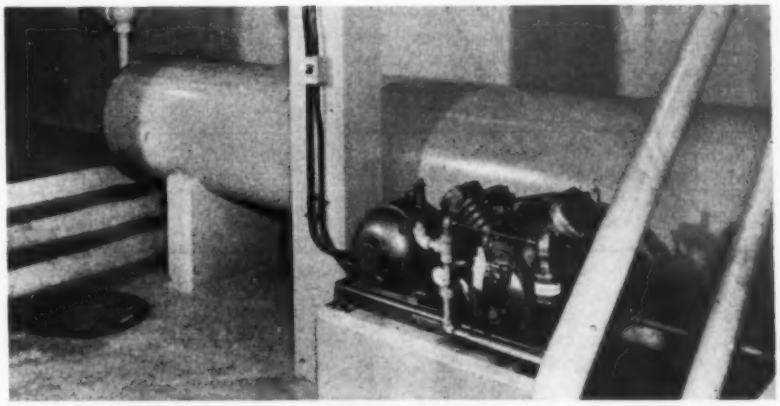
Citizens of Bloomington have insisted on supplying at least a part of their utilities in the past. They started with a city-owned water supply, added generating equipment to supply power for pumping and have proceeded to expand and modernize. Now, with the very excellent results from the diesel installations, they are looking forward to the day when all of the services needed by the community will be supplied by a community owned system.

TABLE 1—PIPING COLOR CODE

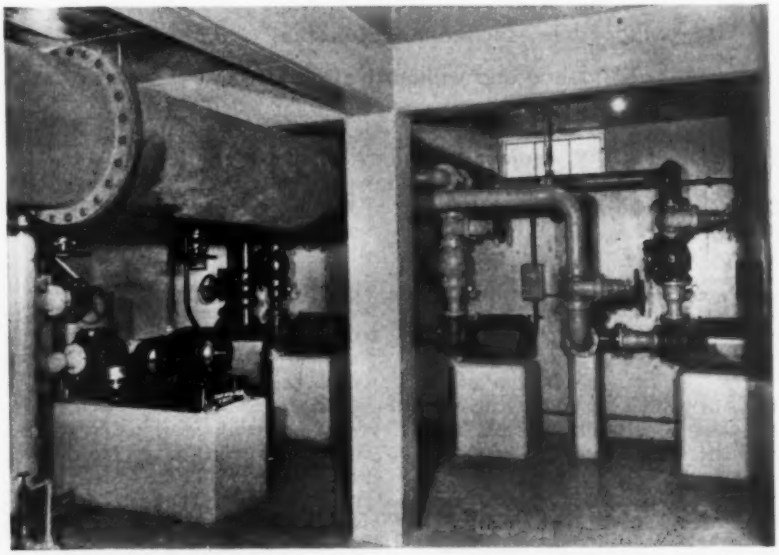
Service	Code Color
Lube oil	Orange
Fuel oil	Brown
Starting air	Yellow
Raw water	Blue
Jacket water	Gray
Raw water	Blue and gray bands
Jacket water	Blue and gray bands
City water	Red

PRINCIPAL EQUIPMENT IN BLOOMINGTON DIESEL STATION

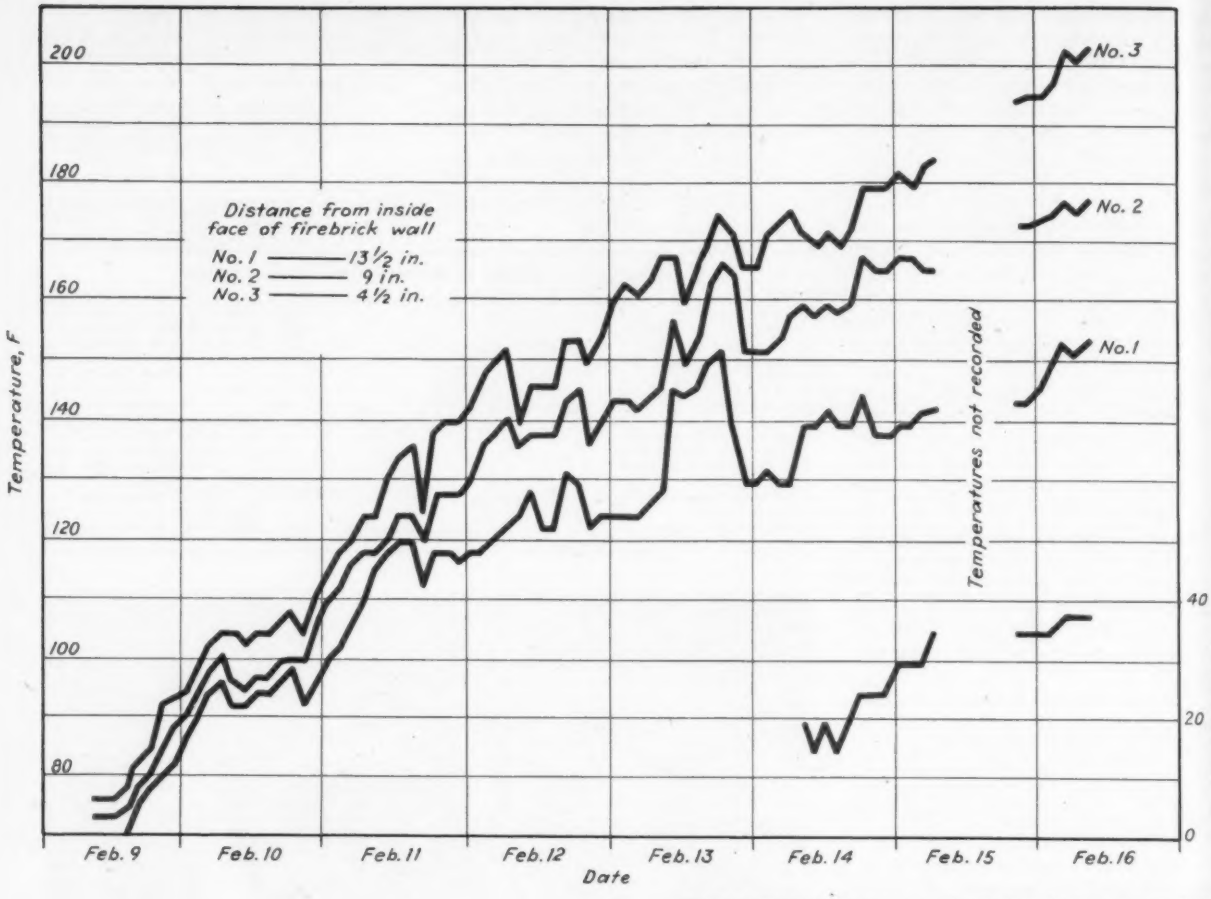
Diesel engine	Nordberg Mfg. Co.
Generator exciter	Elliot Co.
Governor	Woodward Governor Co.
Air compressor	Ingersoll-Rand Co.
Air compressor motor	General Electric Co.
Mufflers	Maxim Silencer Co.
Lube oil filter	Hilliard Corp.
Lube oil pump	Blackmer Pump Co.
Lube oil pump motor	Westinghouse Electric Corp.
Raw water pump & motor	Allis-Chalmers Mfg. Co.
Jacket water pump & motor	Allis-Chalmers Mfg. Co.
Emergency pump & motor	Allis-Chalmers Mfg. Co.
Fuel oil strainer	W. W. Nugent & Co., Inc.
Lube oil strainer	Nordberg Mfg. Co.
Lube oil cooler	Ross Heater & Mfg. Co., Inc.
Jacket water cooler	Ross Heater & Mfg. Co., Inc.



Air compressor and air storage tank comprise the starting air system for the new diesel engine. Compressor has 5 cylinders and is powered by a 5 hp motor



All auxiliary equipment such as raw-water, jacket-water, lube-oil, and fuel pumps are located in the basement. Painted water pipe illustrates color code



Temperatures in furnace walls during drying out period

"KNOW-HOW" FOR STARTING NEW BOILER

Procedure recommended enables an operator to put a new boiler into service with confidence and without waste of time, yet without risk of damage to the setting

HENRY D. FISHER, Project Manager, Westcott and Mapes, Inc.

JOHN L. THOMAS, Superintendent of Power, Bartgis Brothers Co.

INSTRUCTIONS for starting up boilers generally state that solid masonry settings should be dried out gradually and that grease and oil should be removed from the interior of the boiler by boiling out with alkalis, usually stated as soda ash and caustic soda. However, they are vague as to the details of how these operations are to be carried out. Somewhat more definite information has recently been supplied by firms specializing in boiler water conditioning who will make specific recommendations to their clients as to what chemicals and how much should be used in the boiling out, but the authors have been unable to find any published data on the control of the process of drying out the settings.

The plan to be described herein has been employed several times over a long enough period of years to observe the service records of the settings dried out in this way. These settings have given excellent service, have not cracked and have had repair costs much below the average. Much of the credit for these excellent results must be given to the setting contractor whose work was of outstanding quality, but even the best equipment can be spoiled by improper treatment. As far as drying out is concerned, the method of control described here is planned to prevent such mishandling.

A typical example of a drying out and boiling out operation just completed will be described in the hope that it may assist some operators who encounter the problem for the first time.

Standard proposal forms of the

American Boiler Manufacturers Association, indicate that the manufacturer stands from under and states that "The erection supervisor shall not supervise drying, boiling out or starting up". The responsibility for these operations is placed directly on the owner or his representatives.

In practically every case installation of new or additional boiler capacity in industry, the decision to build is postponed until the necessity is obviously inescapable. When this situation occurs there is constant pressure to get the equipment into service as quickly as possible. Furthermore, as the boilers near completion, there are increased demands from the management to get them under steam "sooner than possible" so a speeding up of the drying and boiling out is a relief to everyone.

Setting Specifications

Preparations for these operations should start with the planning of the installation. Boiler specifications should state that the interior of tubes should not be oiled. Lubricants used inside the boiler for expanders or other purposes should be of a readily saponifiable or emulsifiable nature. Soft soap has been used for this purpose and proprietary compounds designed for such service are available.

Boiler specifications should require the manufacturer to state the water content capacity of the boiler, so that the quantity of chemicals required to produce the proper concentration can be calculated.

Setting specifications should provide that sleeves of ½ in. electrical conduit are to be set in the side wall of the furnace, extending in from the outside to just behind the first, second, and third, or more, courses of brick, from the inside of the wall. These sleeves should be located about six in. apart, at about the middle of the furnace from front to back, and at about two thirds of its height from the grate to the top of the furnace space inside.

When the boiler and setting have been finished, all loose material should be removed, plugs or other devices used to keep unwanted objects out of blow-off lines removed, and an oval sheet iron funnel, laid horizontally, installed in the main drum to serve as a surface blow. This can be connected to the continuous blowdown connection or any other convenient drum connection. It is convenient to mark its level on the water column.

The boiler is then filled to operating level with water and the chemicals recommended by the consultant on boiler water conditioning, dissolved in a clean, empty drum and run into the boiler. The drum and superheater vent valves should be left open.

Meantime a supply of wood should have been accumulated, preferably in the form of plank 2 in. thick or heavier. Lighter wood burns away too fast and makes it more difficult to maintain a reasonably steady fire.

A fire three or four ft sq should be started in the middle of the furnace, and the time and temperature in each of the wall sleeves noted. It is preferable to start the fire in the morning to facilitate checking the rate of temperature rise and adjusting the fire accordingly. Accompanying illustration shows a plot of the temperatures recorded during the drying out of a 60,000 lb per hr Bigelow bent-tube three-drum boiler equipped with a spreader stoker. The side furnace walls have 3¼ in. tubes on 9⅝ in. centers backed up by 18 in. solid firebrick walls, and a 9 in. lining of No. 1 firebrick backed up by 9 in. of No. 2 firebrick. There is no water cooling on the front or bridge walls.

Thermometer sleeves were set in the right hand sidewall, located as previously described and provided for measuring temperatures at the following points:

No. 1—13½ in. from inside face of firebrick
No. 2—9 in. " " " " "
No. 3—4½ in. " " " " "

In this case, temperatures were observed and recorded every two hours, but in general practice if this interval is observed during the first twelve hours and then extended to six hour intervals, results should be satisfactory. An effort should be made to hold the temperature rise to between 10° and 15° F in the first twelve hours and at a rate between 25° and 35° F per twenty-four hours thereafter. This would permit reaching a temperature above 220° F, which is the critical point in drying out clay refractories, in about five days. As may be seen from the plot, this is not a method subject to precise control. Variations from a uniform rise in temperature are to be expected with this type of firing. In this case it was difficult to maintain the supply of wood necessary near the end of the drying out process.

Effect of Firing Method

Depending on the method of firing, if the stoker or oil burner can be operated at a very low rate, it may be practical to operate the regular firing equipment after the first three or four days with a material saving of labor as compared with firing wood. Care must be taken, however, not to exceed materially the rate of temperature rise recommended. If an induced draft fan is used in connection with the regular firing equipment, there will be a sharp drop in wall temperatures due to increased air infiltration when the induced draft fan is put into operation. The wall temperatures then cease to be a guide in the drying out procedure.

Boiler Operation

Steam usually will be formed in the boiler some time before the drying out has been completed. Pressures developed in this case are shown in the lower right hand corner of Fig 1. After the air is out of the boiler, the vents may be closed and the boiler allowed to simmer along, occasionally using the surface blow and then refilling. In this way much of the dirt will be removed and not remain to stick to the drum and tubes as the water level falls when the boiler is emptied.

When the temperature at the inner thermometer position reaches the 200°-220° F range the fire may be allowed to die out, the boiler allowed to cool for about twelve hours, emptied, manhole covers removed, drums and tubes washed out and inspected for cleanliness. If this is not satisfactory, the boiling out process, usually for 24 to 36 hours at 30 to 50 psi, must be repeated. However, if reasonable precautions have been taken in keeping objectionable dirt and greases out of the boiler during erection, reboiling might not be necessary.

If the Apexior is to be applied, it is done at this time. After the Apexior is applied or if the plans call for its omission, the boiler may then be closed, filled with water, the initial charge of feed water treatment added, and fires started. It is preferable to operate the boiler for the first two or three days below half capacity, after which time it may go into regular service without damage to the setting.

• PINT-SIZED, when placed beside a steam power plant of equal capacity, the gas turbine installed in the Arthur F. Huey station can reach peak load from a cold start in about five minutes. As a single unit, it is rated at 3,500 kw, and the turbine's waste gas exhaust is used to boost output of the station's existing power plant by another 3,000 kw. Its performance record has far exceeded original expectations.

The unit weighs about 85,000 lb, is less than 50 ft long and nine feet wide, and requires a building only half the size of that necessary to house a steam turbine and boilers of the same capacity. The Oklahoma installation uses natural gas, but low-grade oil can be used equally well. *If you want to keep abreast of developments on the coal-burning gas turbine look for the progress report in June INDUSTRY & POWER.*

PIN AWARDS BETTER EMPLOYEE RELATIONS

Recognition of individuals and groups can do a lot toward making employee relations click in any organization. Given proper dignity, service-pin awards build good will, because they are ties that bind people together

ROGER CLARK, Management Consultant

UTILITY EXECUTIVES have long recognized that keeping the individual employee contented, maintaining his attitude of loyalty toward employer and job, is not the least of many factors making for good labor relations. And, regardless of the utility "labor problem" in its broader aspects, this question of maintaining a satisfactory close-range relationship between employer and employee is largely one for the individual employer to solve.

Several methods have been devised and used with success in recognizing and honoring length of service in gas and electric utility organizations, and the practice of awarding service emblems is rapidly on the increase. Now it usually supplements all other forms of recognition.

Award Benefits

In the long run, of course, all such projects result in increased production, fewer management "headaches", greater plant efficiency and better quality work.

In considering this highly important factor in good employee relations, employers must consider all methods. Recent surveys over a cross section of employing concerns (with 100 or more employees) brought to light some interesting and useful ideas. For instance; the cash reward has been used by some employers, and, we know, cash is always welcome to the employee.

Yet, it has been found that cash awards are apt to be over-costly to the employer. Then, too, it is not always easy to establish a cash award or awards on a fair basis. And, the *effectual* "life" of the cash gift is usually short, once the employee getting it has spent the money. As a rule, experienced employers prefer to tie in cash awards with honorary emblems as a means of prolonging the "memory" of the occasion when both were presented.

There is, also, the system of gifts, and the gift is a valuable award providing, of course, it is suitable, also that it be tied in with the emblem. Otherwise, the gift, may serve only a *limited* time as a "live" reminder of the long service that earned it.

Giving emblems for recognition, achievement or incentive is most effectual, however, say those who have used them over the years, when the practice is an *established* project or program with procedures that insure the best long run results both to employer and employee. The beneficial effects of such awards lie, to a great extent, in their being publicized as much as possible in the organization among the recipients own co-workers, and also in the community. The latter tends to establish the organizations as "a good one for which to work".

Accordingly, the objectives of the employer must be:

1. To gratify the pride of the employee who has earned recognition for continued service.

2. To keep alive remembrance of the presentation among all fellow employees as well as of the recipient.

3. To establish an incentive for other employees to gain similar honor.

4. To bind the employee to employer and job more loyally through this very human and voluntary act of recognition.

Swift's Program

The awards program that has prevailed for years at Swift & Co., and which has attracted widespread attention for its success, is described by Harold F. North, Swift Industrial Relations Dept. as follows:

"Since 1938 when the "Report to Employees" edition of our Swift News was begun, we recognized length of service for Swift employees by printing the names of those with twenty and more years of service. This proved popular among employees, but offered only annual recognition. Of course, vacations with pay, increased illness benefits, non-contributory pensions,

and other similar programs provide what amounts to financial recognition for long unbroken service.

"In the light of our experience with the publishing of names and recognizing that man lives 'not by bread alone', we began to look for other ways to give service recognition. We sensed that an individual likes to feel he is part of a team, and naturally seeks some way to identify that association whenever the opportunity presents itself. Naturally the service pin offered the best recognition of this interest. It is our intention that each November edition of the Swift News will become the service recognition edition".

Great advances have been made in the design and production of service emblems and millions of them are now produced and distributed each year in American industry, education, transport, commerce, business, and hundreds of other fields of human activity where service and loyalty are to be recognized.

Let us consider some of the features of such a program:

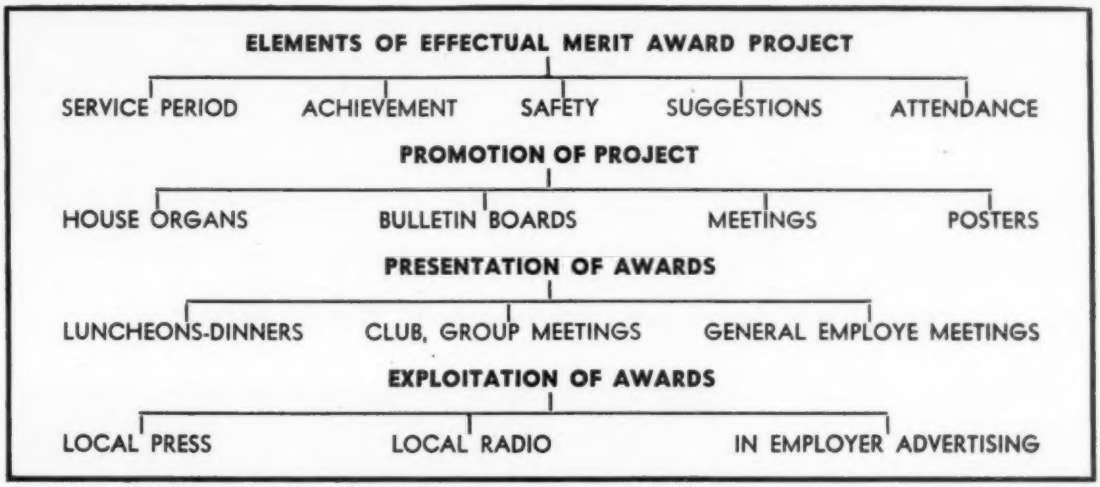
In adopting such a program, even to a limited extent, or even on a trial basis, the employer is taking advantage of some well established traits in human nature. Because most workers of all types naturally take pride in their work and an interest in achievement, largely to the extent to which it is not only recognized but *rewarded*. Many employers believe that emblematic awards, properly presented and with the best possible "promotion", may be counted among the most valuable techniques in building a sound industrial or employee-relations program. (Suggested reading is: "It's Still A Good Idea" American Publishers, Box 116, Utica, New York.)

Primary occasions appropriate for emblematic awards, may be summed up:

1. Recognition of seniority.
2. Length of service acknowledgment.
3. Quarter-century clubs.
4. Seniority, in a section, zone or department.
5. Production, or accomplishment recognition.
6. Safety record.
7. Constructive ideas provided and/or suggestions made.

Certain users have found that, in some instances, such programs fail to succeed to the extent expected. The fault nearly always lies in the lack of a good program to sell the idea properly and to make the most of its application. To call an employee into the manager's office, for instance, to make a recognition award, man-to-man or woman-to-woman, accomplishes little, because, it is also the "other fellow" you wish to impress. This is the co-worker who is influenced to "go and do likewise"—after getting visible evidence that the boss really does appreciate good work and proper conduct, and is willing to openly acknowledge and reward it. Time and place of presentation is of the greatest importance.

One form of presentation is to make the occasion a luncheon or supper either with the whole organization present or those directly involved. Experienced people in this work suggest that the highest possible official *per-*



Active promotion of awards is important. Here in "line organization" form are the ways to do the job. Remember: Friends, relatives, the community should know of a man's achievement

Presentation procedure is particularly important because it can add significance to the award. Arrange special ceremonies and publicize the event

sonally make the presentation, and the citation clearly state exactly *why* it is made. At the same time, any future award opportunities are also announced and department heads are encouraged to take the winners to lunch or otherwise entertain them as a means of emphasizing the event.

In some instances, employers have found it a good idea to project Kodachrome slides on the screen at the time of presentation to accentuate the beauty of the emblem award. This is done by The Tampa Electric Co. At the banquet celebrating the original establishment of their award program they project slides on the screen and point out to their employees the finer details of the design and illustrate the various qualities of the emblems—the higher the year group the finer the quality.

When the five-year group are called up to receive their awards their emblem is thrown on the screen as is the ones for the 10-, 15-, 20- and 25-year groups. Subsequent annual presentation observances are built up with prepitious ceremony to enhance the importance attached to the award and, at the same time, make the occasion so enjoyable as to be one which employees look forward with anticipation.

Armstrong Cork's Program

For instance, the personnel award play for years maintained by Armstrong Cork Company, and which is based upon scientific studies of all phases of the recognition award, has attracted widespread national attention. Concerning this employer's views on the method of presentation, Vernon W. Pitcher, Senior Personnel Assistant, Armstrong Cork Company said:

"The Armstrong Cork Company is convinced that the success of any business venture depends directly on the effectiveness of its organization. A personnel program must contribute to the effectiveness through policies and techniques, which obtain and develop capable employees. An important part of our program is the provision of *individual* and *group* recognition to employees for their contributions to the organization.

"We believe that employees as individuals or groups desire recognition as well as a right to receive it.

"Of particular importance is the manner in which these various awards are presented because the procedure can add significance to the award. Our service awards are presented by a member of top management in special ceremonies at annual banquets. Safety plaques are also presented at special plant ceremonies. Suggestion awards are always presented by the employee's supervisor and pictures of the presen-

(Continued on page 157)

How to Insulate Cylindrical Duct Work

Cylindrical duct is often difficult to insulate, because it is too large for preformed pipe insulation, and the surface curvature is too great to permit sticking the insulation temporarily, prior to strapping.

One company gets around this problem on exhaust-fan duct this way:

1. Dirt, grease, and other extraneous material is cleaned from the surface of the duct with a wire brush.

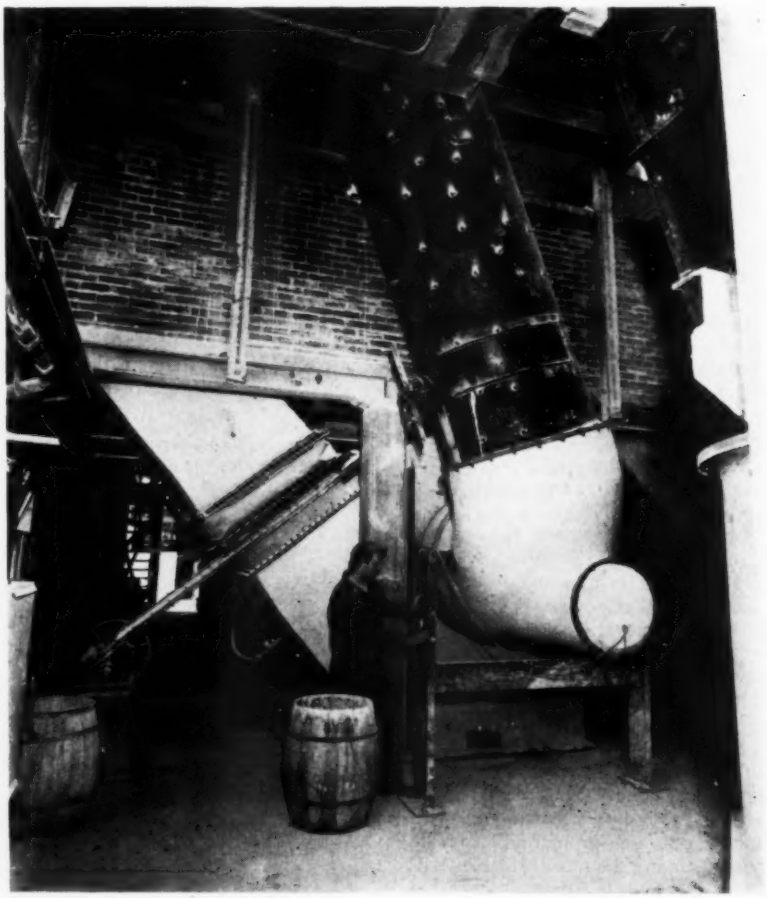
2. Eight-inch lengths of galvanized wire are spot welded to the surface of the duct as shown in the illustration to the right.

3. One-inch-thick mineral-wool blankets, sandwiched between expanded metal lath and light-gage, galvanized-wire mesh, are impaled on the projecting wires. The expanded lath faces out and the protruding galvanized wires are bent over to hold the insulation in place.

4. The sections of blanketing are laced together at the edges by galvanized wires intwined in the lath.

5. Finally, the blanket is covered with a one-half-inch layer of mineral-wool insulating cement troweled over the mesh-type surface of the expanded metal lath.

Although this particular job is to prevent excessive heat radiating into the plant and making work areas uncomfortable for operating personnel, similar installations are often valuable fuel savers that increase the efficiency of operating equipment. Industrial Mineral Wool Institute, 441 Lexington Avenue, New York City.



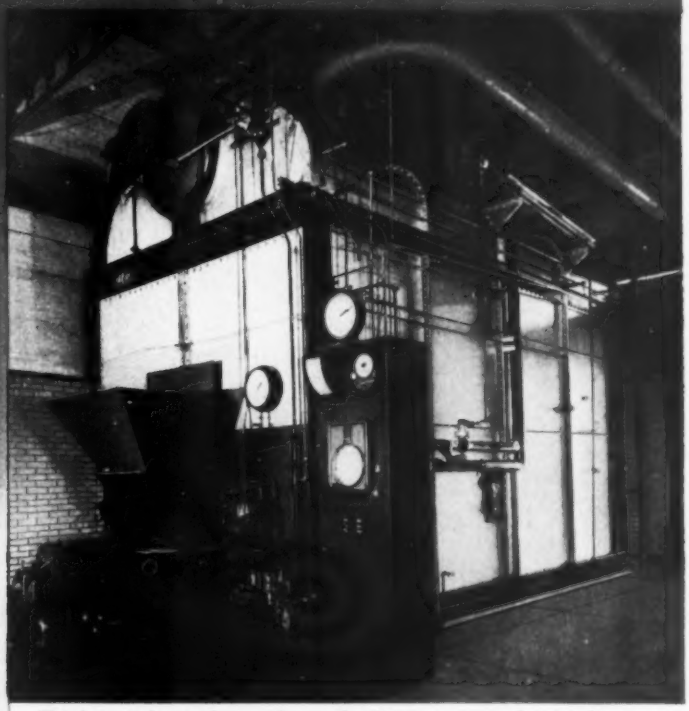
Lengths of heavy wire spot welded to large diameter duct work act as anchors to hold insulation blankets in place for final surface finish

UNION "S" STEAM GENERATOR

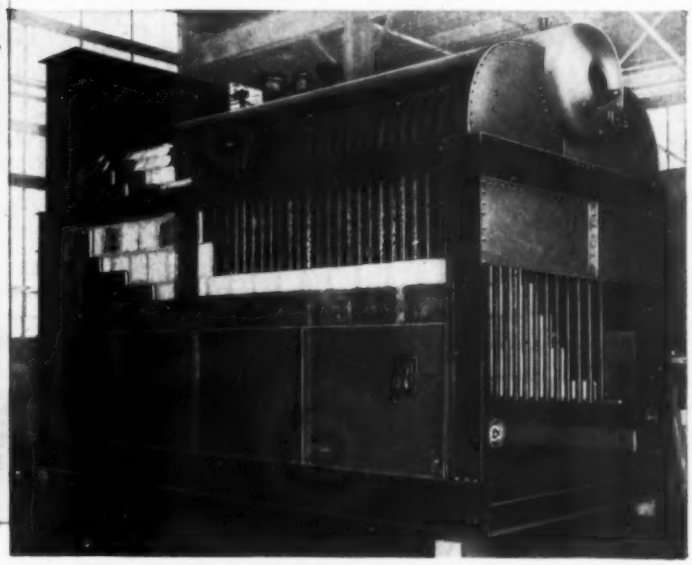
WATER COOLED FURNACE . . . SHIPPED ASSEMBLED

Change your dingy boiler room into a show spot.

This compact Union "S" Steam Generator with its completely steel clad, insulated setting and streamline appearance is as efficient as it looks. You'll be surprised how little floor area and height is required. You can profit from efficient furnace cooling and adaptability to low grade fuels. Its large water holding capacity, its rapid and positive circulation make it extremely safe and economical to operate.



This large tool manufacturer knows that it pays to use modern machines, so why not a modern power plant? He has it in the Union "S" Steam Generator.



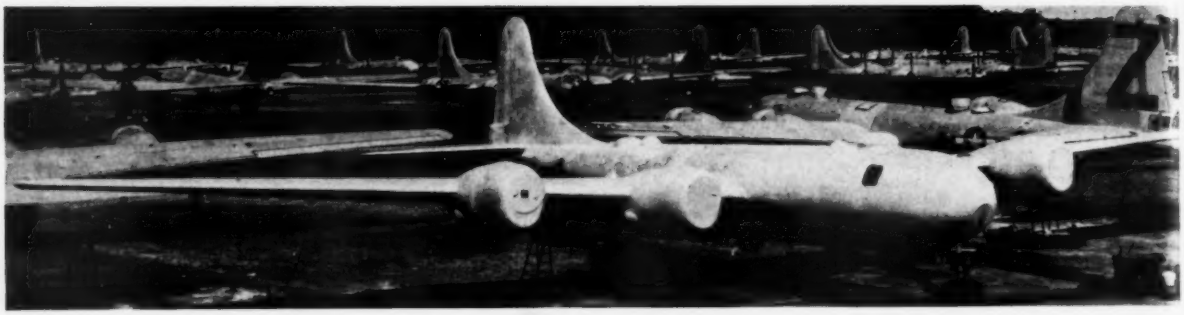
Union "S" Steam Generator being assembled—note side and top wall construction—fire clay tile—block insulation and steel casing.

Write FOR BOOKLET 119

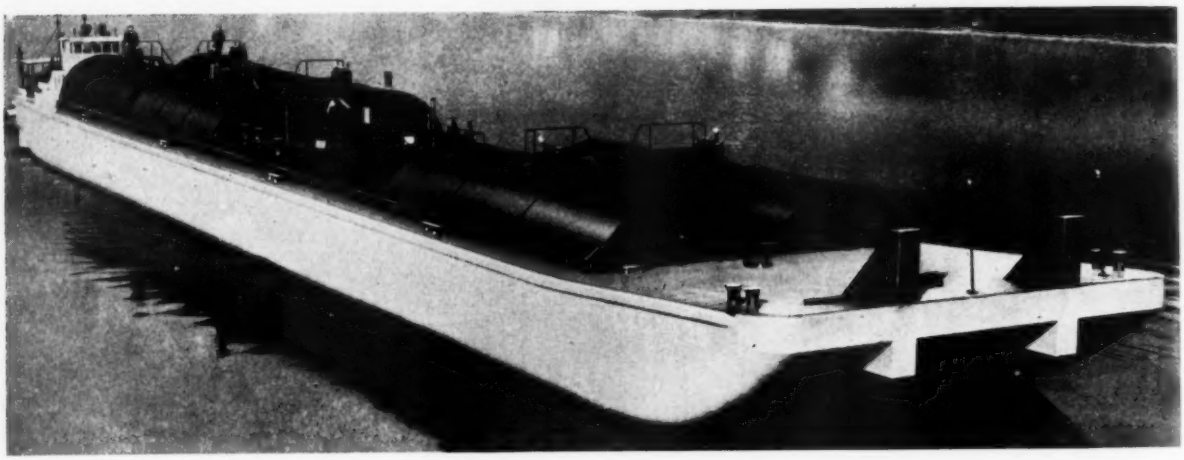
UNION IRON WORKS . . . *Since 1890*

503 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL



Everyone is familiar with the plastic coating developed to protect the millions Uncle Sam invested in storing his planes and ordnance. It is a liquid vinyl plastic. Mixed with mastic, it becomes a heat insulator as on the barge oil tanks below



VINYL USED AS THERMAL INSULATION

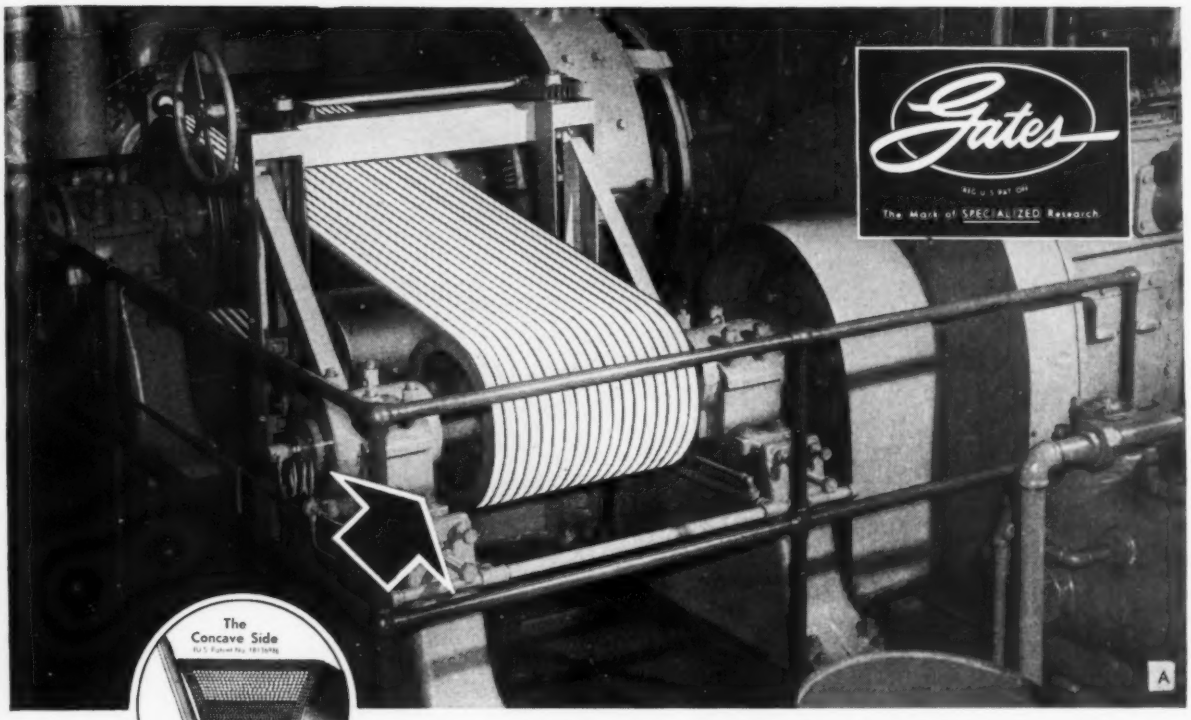
First adopted to preserve stored war equipment, this plastic has now been combined with mastic coating to provide insulation without asbestos cement

WHEN INSUL-MASTIC vinyl system was initially developed for long-term storage and preservation of aircraft, ordnance, radar and other vital and costly war material for the U. S. armed services, no one foresaw that this packaging job would some day lead to vaporsealing for thermal insulation. Recently, Insul-Mastic Corp. developed an adaptation of its combination plastic and mastic coating which overcomes the difficulties heretofore involved in placing a weatherproof coating over soft, semi-rigid thermal insulation without the use of asbestos cements.

In using the coating to vaporseal, protect, and reinforce insulation, only a slight change in application procedure was necessary. The application consists of spraying a coating of liquid vinyl plastic, and Gilsonite mastic. In long-term storage applications, the vinyl coat is sprayed in long webs so as to bridge gaps caused by uneven contours. The webs are woven in a criss-cross manner to form a base for the application of about 30 mils of vinyl. The even surfaces of thermal insulation makes this bridging action unnecessary except for minor webbing over joints. Therefore, in its new application, the vinyl is flowed over the insulation in a liquid state, making a tougher, more uniform coating.

The Gilsonite mastic is sprayed over the vinyl base to form the moisture barrier. This protective coating was recommended to the government by an independent testing laboratory and was the only coating to pass the original government specifications for the work. Gilsonite Insul-Mastic has a moisture-vapor penetration rate of only 0.01 grams per 100 sq in. per 24 hr, and it was stated by the recommending laboratory that it would give protection from the elements for approaching fifty years. This longevity and low moisture vapor transmission rate are factors influencing its acceptance in industry. It is reported that as insulation it is not only vapor-proof, but it will neither expand nor contract and will not crack.

In the armament storage program, it bridges gaps of over 20 in. without support and forms a firm base for the mastic coating which follows. Applied over insulation it is reported that only the severest blow or a sharp instrument is able to penetrate it. The vinyl has a tensile strength of 1,500 psi. Both the vinyl and the Gilsonite asphaltic coats have the advantage of being spray applied This affords a uniform job.



When the engineers in a New York machinery plant were faced with the problem of driving an auxiliary generator from an engine, powering an air compressor, they worked out this interesting drive arrangement. "The Gates Vulco Rope Drive made it easy for us to set up a completely adaptable power arrangement," says the plant engineer.

Here is exactly ***WHY*** the Concave Side Saves You Money in V-Belt Costs

When *any* V-belt bends in going around its pulley, it is forced to *change* its *shape.*

Naturally so, because the top of the belt is under tension and grows *narrower* while the body, under compression, *bulges out!*

This change of shape in a *straight-sided* V-Belt, is shown in figures 1 and 1-A—and you will note how the bulging sides press *unevenly* against the V-pulley.

Now look at figures 2 and 2-A. There you see how this change of shape, due to bending, affects the belt that is built with the Concave Side—the Gates Vulco Rope. The precisely engineered Concave Side exactly corrects the side-bulge—and the bent belt *has a shape that exactly fits its sheave groove!*

Two distinct savings result. *First*—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life!* Second—The *full width* of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also saves *power!*

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides... the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt

How Straight Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear at Poiht Shown By Arrows.

Gates Vulco Rope with Concave Side

No Side Bulge. Precise Fit in Sheave Groove. Sides Press Evenly Against V-Pulley—Uniform Wear—Longer Life!

CS-505

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks **IN ALL INDUSTRIAL CENTERS** of the U. S. and 71 Foreign Countries

Spot News

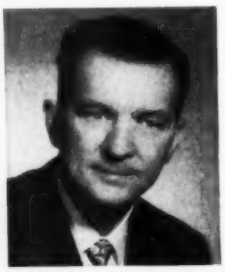
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Industry and Power Adds Outstanding Engineers To Editorial Staff

In our constant effort to maintain INDUSTRY AND POWER as the top publication in its field, we have increased the size of our editorial staff by appointing A. B. White as associate editor, and Frank C. Donohue as assistant editor. Both men have enviable records in industry.

Al White served as research engineer for six years and a director in the Welding group for one year at the Westinghouse Research Laboratories, and has had wide experience in electric power utilization and distribution. He was engaged in many wartime research projects, including electrical instrumentation, radar, jet propulsion and nuclear physics; also, in developing manufacturing techniques suitable for mass production of equipment evolved in the laboratory. During this period he obtained numerous patents on welding processes, power-supply equipment, and electronic control units. Welding equipment in Westinghouse's $160,000 welding laboratory was installed under his direction.

A. B. White



F. C. Donohue

Two years ago Mr. White joined the Clark Equipment Co., manufacturer of automotive parts and material-handling equipment. As welding engineer he supervised welding operations and equipment maintenance, and was responsible for original developments in electro-forging and welding processes.

A graduate of Notre Dame, Mr. White holds degrees of BS in electrical engineering and MS in mathematics. Upon graduation he remained at that university for two years as laboratory assistant. He is a member of the American Welding Society, has presented papers at AWS national meetings, and at present is vice-president of the AWS Michiana Section.

Frank Donohue served as warrant officer in the Navy, specializing in radio and electronics. He wrote technical articles on these subjects, and acted as ship's press liaison officer. For the past four years he has been engaged in press wireless communications, covering foreign news, as well as engineering and business articles of international scope. He was engaged in the same work prior to the war. Mr. Donohue is a practical engineer with 20 years experience in electrical engineering, and with an educational background that includes 10 years continuous study in night classes in New York colleges and universities.

Ore Hoist Hauls 12-ton Load from 4,335 Level in Two Minutes

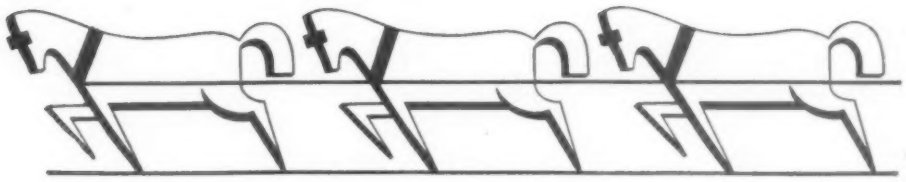
The largest mine hoist motor in the country from the standpoint of physical size is being installed by the Anaconda Copper Mining Co. at Butte, Mont. The G.E. 600-volt d-c motor, rated 3000 hp at 60 rpm, will drive an ore hoist at the Kelley Shaft, an important part of Anaconda's $20,000,000 "Greater Butte Project" for the recovery of low-grade copper ore by the caving method. When installed, the motor will be direct connected to the hoist drums.

In addition to the hoist motor, the G-E drive equipment includes a 2500-kw, 600-volt d-c generator driven by a

3500-hp, 514-rpm, 2400-volt synchronous motor; a generator exciter; complete hoist control; and switchgear-type starting equipment for the MG set.

The electric drive will be able to hoist 12 tons of ore per

HARNESS WASTE HORSEPOWER WITH

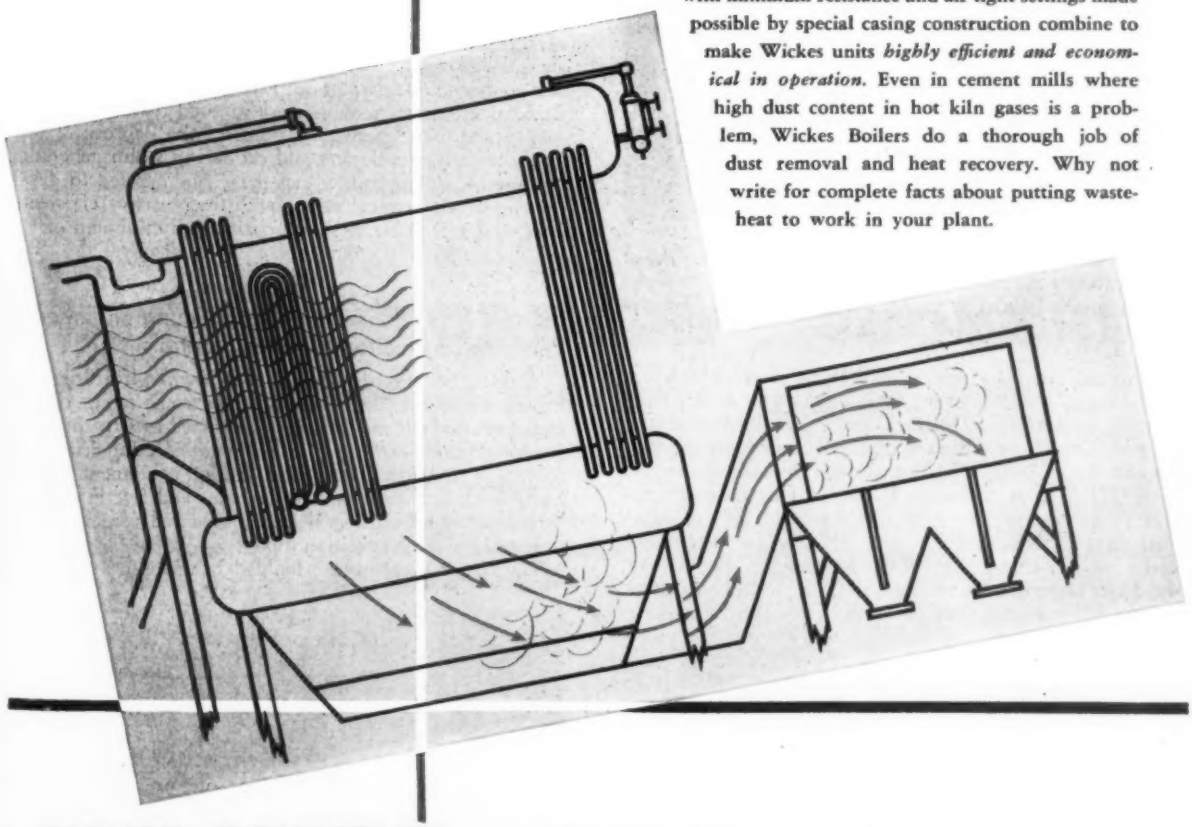


WICKES WASTE-HEAT BOILERS

CONVERT WASTE-HEAT into PROFITABLE POWER

Waste heat, once discharged from manufacturing equipment as a loss, has been made to realize a high economic return through the installation of Wickes Waste-Heat Boilers. In actual cases, the reduction in the costs of manufactured products has *paid for the waste-heat installation* within 2-3 years time, and in some industries, heat recovery is sufficient to produce all steam and power required.

Wickes Boilers are correctly designed and built to effect maximum heat recovery from all types of waste gases. High gas velocity, long gas travel with minimum resistance and air-tight settings made possible by special casing construction combine to make Wickes units *highly efficient and economical in operation.* Even in cement mills where high dust content in hot kiln gases is a problem, Wickes Boilers do a thorough job of dust removal and heat recovery. Why not write for complete facts about putting waste-heat to work in your plant.



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RECOGNIZED QUALITY SINCE 1854

trip at a rate of almost half-a-mile a minute. Operating at full speed it will be able to complete a trip from a depth of 4,335 ft in slightly more than two minutes.

Man-Made Cosmic Rays are 14 Billion Times Stronger Than the Sun's

New horizons in nuclear research are beckoning physicists at the University of Illinois, where a new 300-million volt betatron recently came to life with a steady output of 20 times more electrons than any other machine ever produced. This created artificial cosmic rays 14 billion times as intense as nature's own emanations from the sun.

Dr. Donald W. Kerst, university physicist and inventor of the betatron, predicted that future study of meson events generated by these powerful x-rays will reveal new phe-

nomena of great significance, including a possible revelation of what holds the atom together. Cosmic ray characteristics will be studied through microscopic examination of series of photo-exposures and direct observation of "cloud chamber" photos.

More important to industry will be the eventual transfer of additional laws of physics from theory to practical engineering, opening new fields of design and development.

In a review of the project to date, Dr. Kerst acknowledged the role Allis-Chalmers played in construction and erection of the huge x-ray machine. The main flux magnet, constructed on the university campus under supervision of Allis-Chalmers engineers, is the largest a-c magnet ever assembled. Weighing 275 tons and measuring 23 ft long, 6½ ft thick and 13 ft high, the main magnet contains 70,000 sheets of transformer iron. Six field magnets each weigh 12 tons.

Metallizing Saves Money on Turbine Repairs

We have just received two short reports apropos time and money saved is repairing steam turbines with sprayed metal. One comes from the BMT power house in Brooklyn, N. Y., where erosion has taken place on the casing between the last four rows of stationary blades of a 20,000 kw turbine. It was decided to metallize only one end of the turbine with stainless steel and to operate it one year, after which the coating could be inspected to determine whether the other end should be sprayed. One year later when the turbine was inspected the sprayed coating was carefully sounded and found to be perfect. The general appearance of the coating was that it had just been applied; there was no sign of erosion or corrosion. The other end was then sprayed. Inspection five years later showed the coating on both ends of the turbine to be in first class condition.

Another metallizing user repaired a leaking gland case of a 2500 kw bleeder type steam turbine in sixteen hours. The eroded spindle gland case threatened to result in complete failure. Replacement would have caused extended shutdown and the repairs could not be made by welding since excessive heat would warp the case. The case was removed, grooved, grit blasted, metallized with stainless steel and machine finished. The job took less than sixteen hours. User states, "The cost of the replacement would have been one hundred times more than that for the time and material required in metallizing."

"Cyclone Furnace" Burns Low-Grade Coal In Whirling Tornado of Flames

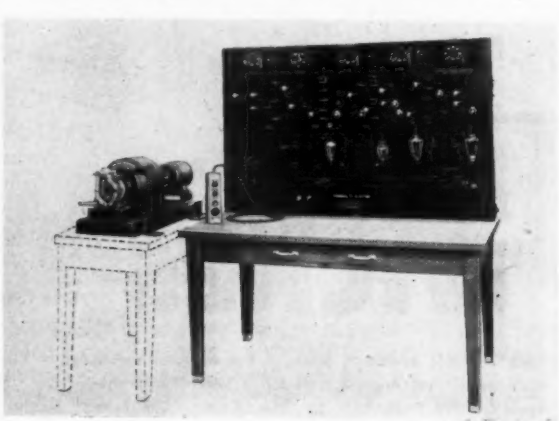
A new type of furnace for large industrial boilers which generates heat up to 3000° F and at the same time greatly reduces residue from smoke stacks was described recently at a meeting of the Southeastern Electrical Exchange. Known as a "cyclone furnace" the device will burn crushed coal and other fuels in a whirling tornado of flames which produces high temperatures to assure burning of all combustible material. Centrifugal action throws non-combustible residue against the furnace walls to melt and drop into a pit as slag.

R. K. Allen, staff engineer of the Babcock & Wilcox Company, which developed the "cyclone furnace," told the electrical group that the cyclone principle was first used by the company in the early 1930's while developing a compact, self-contained incinerator to help solve municipal refuse disposal problems. Results were so good that the principle was turned to the primary business of the Babcock & Wilcox Company, developing and producing steam generating equipment. Allen pointed out that "findings led to development of the present cyclone with the object of efficiently burning lower grade, high ash coal with a minimum of fly-ash discharge and minimum slagging difficulty."

Special Unit Devised to Teach Young Engineers Features of Electronic Motor Controls

A full-wave reversing educational Thy-mo-trol drive, designed to assist in the teaching of electronic motor control and associated circuits, has been developed as a teaching aid for engineering colleges and plants offering employes courses in electricity. The demonstration equipment is illustrated here. It consists of seven circuits and five instrument panels assembled on a steel frame, mounted vertically on a steel table with composition top.

The circuit diagrams are molded in white into the front



of dark laminated textolite panels. The actual wiring and all components, excepting the tubes, are behind the panels, with all important circuit points brought to the front of the panel by insulated banana-plug jacks. This educational Thymo-trol reversing drive embodies operating principles and essential components identical with those of the standard commercial General Electric full-wave reversing Thy-motrol drives.

Solvent Licks Stubborn Cleaning Problem on Turbine-Generator Sets

After being used in a war plant, three 5,000-kilowatt turbines were coated with a rust preventative material. Two years ago, when the turbines were being prepared for operation, attempts to clean the oiling system were fruitless as considerable of the rust preventative material seemed irremovable. Deposits collecting in spaces of small clearance, including the speed governor, made the turbines unreliable.

Following a six hour flushing with S/V Sovalent A, maintained at a temperature of 150° F, all traces of the rust preventative material were removed. Since then the three turbines have been performing satisfactorily, according to Socony-Vacuum.

New England States to Tap Big and Little Inch Pipelines for Natural Gas

Texas Eastern Transmission Corp. has concluded a contract with Algonquin Gas Transmission Co. for the delivery of up to 250 million cubic feet of natural gas a day for resale by Algonquin to utilities in the New England area.

Texas Eastern and Algonquin have applied to the Federal Power Commission for authorization to construct the necessary facalities to serve the New England area. Hearings on the two applications are expected within the next few months. If favorable action is taken by the FPC, actual construction can be started by the end of the year so that deliveries of gas may be started in time for the winter heating season of 1951-52.

Required new facilities to be added to the Big Inch and Little Big Inch system would cost approximately $60 million. The pipe line system that Algonquin proposes to construct from a delivery point on the Big Inch system near Lambertville, N. J. to serve substantially all the gas distributing companies in the New England area would cost approximately $27 million.

Long Prestressed Concrete Spans Going into Buildings and Bridges

Prestressed without the use of expensive equipment, reinforced concrete spans can be made 75% longer in general construction without changing slab or beam depth. Simplicity of the method, says Karl P. Billner, engineer who developed it, makes prestressed concrete economical for use in ordinary construction and bridges and hangars.

During a demonstration at Brooklyn Polytechnic Institute last month two beams each 30 ft long by 2 ft wide and 1 ft thick were tested. High-strength steel wires were used for reinforcing the beams but only one fifth of the amount of steel was used that is normally required for reinforced concrete not prestressed. Put to a long series of tests by mechanically applied pressures, the beams took several times the known load capacity of ordinary reinforced concrete beams of similar dimensions.

Upon successful completion of the tests, Edward Jacob Squire, head of the Department of Civil Engineering of the Brooklyn Institute, hailed the new prestressing method as

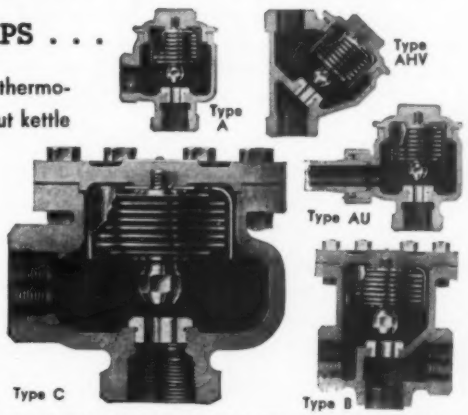
Well-Known Processor

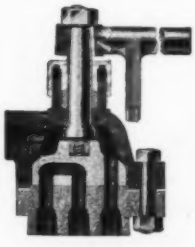
PUTS 37% MORE THRU COOKERS

with NICHOLSON STEAM TRAPS . . .

A leading drug manufacturer found that a recent Nicholson thermostatic steam trap installation, replacing a mechanical type, so cut kettle time that their production was increased 37%. Reasons for Nicholson's faster heat transfer: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air-venting.

Send for Trap Catalog 250 or see Sweet's





CONTROL VALVES for ALL MEDIUMS

For steam, water, air, gas, oil; and for all types of operation—lever, foot, solenoid, motor. Choice of 6 metal combinations to meet specific needs. Pressures to 5000 lbs. CATALOG 546.

5 TYPES FOR EVERY PLANT APPLICATION—power, heat, process. Sizes 1/4" to 2"; any press. to 225 lbs. without changing or adjusting valve.

W. H. NICHOLSON & CO.

135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

"a major advance in concrete construction" and predicted that it would permit general use of prestressed concrete for the first time.

Mr. Billner envisions broad use of prestressed reinforced concrete in construction of garages, stores, schools, factories, apartment buildings and on any type of structure where a minimum of columns is desired. He has estimated that for such buildings two-thirds of the columns could be eliminated through use of prestressed elements.

Outstanding features of Billner's new method include elimination of costly anchorages, the prestressing of all wires simultaneously, and simplified methods of forming. The method is to be made available in this country through Vacuum Concrete, Inc., headed by Mr. Billner.

Buell Engineering Company Acquires Rights To Build Swedish Electric Precipitator

Rights to manufacture and sell the Swedish "SF" electrical dust precipitator in this country have been acquired by Buell Engineering Company from Svenska Flaektfabriken, subsidiary of ASAE (Swedish General Electric Company).

Joseph Messenger, Buell's vice-president accepts the contract from President Edstrom of Svenska Flaektfabriken. Watching proceedings is J. H. Nicholls, Buell's treasurer

Though the "SF" precipitator is new to this country, it has been sold in world markets for 18 years; 150 installations in eleven countries are currently being operated on all types of valuable and nuisance dusts.

With the "SF", Buell now offers a complete line of dust collection systems, including high efficiency cyclones and low-draft-loss baffle type collectors.

Sky-Scraper Towers Will Carry Transmission Lines for California Project

Two of the world's highest electric transmission line towers, thrusting 437 feet into the air, will carry Bureau of Reclamation power over half a mile across the Sacramento River above all shipping near Rio Vista, Calif. The two towers will be about three-fourths the height of the Washington Monument.

Two other towers, 337 ft high, to carry the high tension lines across the San Joaquin River, and three anchor towers, 121 ft high, will also be erected.

The towers, when completed, will support two 231-mile 230-kv transmission lines from Shasta Dam to Tracy, across the two rivers, to supply 150,000 kw of energy for irrigation pumping and municipal and industrial use in the Valley.

The 3,810-ft span across the Sacramento River will be nearly three times the length of the normal single-span used in such crossings. The sky-scraping towers are necessary to lift the long single-span of wire sufficiently high to prevent interference with navigation in the river below. The San Joaquin River crossing will be a 2,300-ft single span.

Systems Developed to Record Pressures Over Distances As Great As 30 Miles

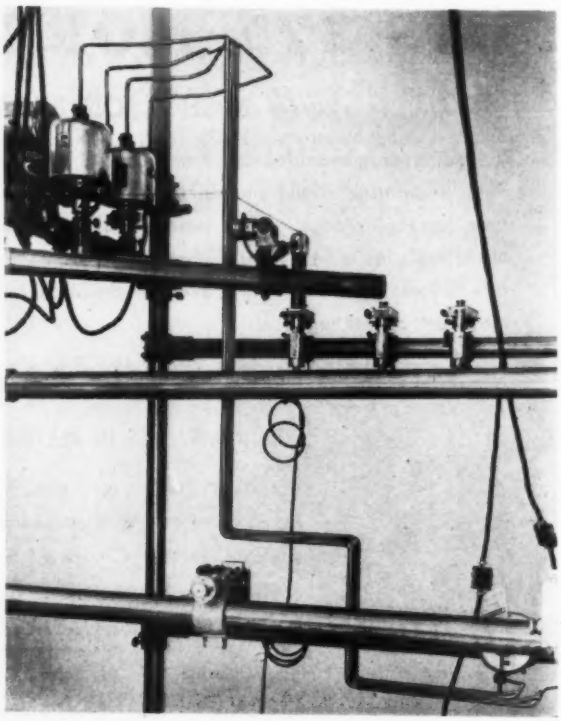
A measuring system has been developed to record electronically pressures up to 30 miles from the point of measurement. Typical applications for such a system, which permits long transmission of pressure to 50,000 psi, is the determination of level of reservoirs located long distances from cities. In such a case, continuous measurement could reduce spill-over water losses where one reservoir is fed from others.

The system, developed jointly by Manning Maxwell & Moore, Inc., and the Brown Industrial Division of Minneapolis-Honeywell Regulator Co., consists of the Microsen transmitter, a transducer which senses change and converts the change into electrical energy, and a remotely located Brown ElectroniK indicating or recording instrument to which instrument the energy is transmitter. Multi-point recorders can be employed where it is desired to log a number of pressure records on one chart.

Tests High-Pressure High-Temperature Piping That Carries 1,370,000 lb steam per hr

The illustrated four-pipe model main steam line, the prototype of which will be installed in Consolidated Edison's Hudson Avenue Station in Brooklyn, N. Y., is shown here during recent test on the M. W. Kellogg Company's exclusive model piping system flexibility-analyzer. The installation, due for completion the last part of this year, will operate at 1050° F and 1500 psi pressure.

The unusual amount of steam passing through the main steam line (1,370,000 pounds per hour), made it advisable to use four-pipe construction to feed the 60,000 kw topping



turbine. The use of multiple piping instead of a single pipe not only reduced the cost of the installation but also provided for the necessary flexibility. Steam from the new turbine is exhausted into the existing low-pressure system, thus measurably increasing the over-all plant efficiency.

By means of the model test on the Kellogg equipment, engineers were able to obtain accurate data on operating stresses. Included in the piping system are four 10-in. diameter leads from the boiler to two 14-in. diameter connections to the turbine stop valves and steam chests.

Foot Power Raises "Bosun's Chair" or "Peddling Yourself to the Top"

Foot-operated, one-man platform hoists are being used to inspect, repair and paint buildings and elevated structures. Called the "Bosun's Chair," it consists of a rigid tubular steel cage which is moved by means of a winch. Sitting on a bicycle-type saddle having two coil springs, the worker operates standard bicycle pedals to raise or lower the hoist. It is also possible to work from a standing position.

Power is transmitted from the pedal crank to the winch drum by a roller chain, running on sprocket wheels arranged in a ratio that permits operation with minimum effort. Movement of the hoist in either direction may be as fast as 25 ft per min under the complete control of the operator. Use of foot power leaves the worker's hands free. According to the manufacturer, Safway Steel Products, Inc., rated capacity of the "chair" is 625 lb.

Bureau of Standards Brings Magnesia's Thermal Conductivity Up to Date

Calling attention to a recent test by the National Bureau of Standards, Marshall F. Allen, Manager of The Magnesia Insulation Manufacturers Association, points out that figures heretofore in common use for the "k" factor and density of 85% magnesia insulation are based on tests conducted by the Bureau in 1919.

Recent tests made on 85% magnesia block of current manufacture, weighing 13.2 lb per cu ft, indicated a k-factor, or thermal conductivity value, of 0.39 at 130° F mean temperature. According to Mr. Allen, these values are in close agreement with averages of the results obtained in numerous conductivity tests by the manufacturers on the current product. These averages were given as follows:

Mean Temp F	k
100	0.39
300	0.45
500	0.51

The k-values cited are expressed in units of Btu per hr per sq ft for a temperature gradient of one deg F per in. of thickness.

"These values represent no sudden change, of course," Mr. Allen stated. "They are simply up-to-date figures, representing steady improvement since the last Bureau of Standards tests were made some thirty years ago."

(Continued on page 160)

THIS MAN

will put your PUMPING OPERATIONS on a PAYING BASIS

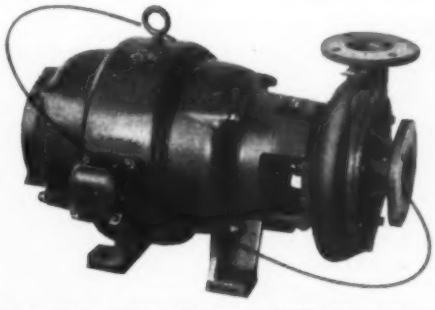
he's a

WEINMAN SPECIALIST

This man . . . symbolic of the entire WEINMAN organization . . . has the latest pumping information at his fingertips. He can look at your present liquid handling equipment and tell you whether it is making you . . . or costing you . . . CASH DOLLARS. Professionally he lives alone . . . with centrifugal pumps . . . and likes it. For pumps, the ONLY product made by WEINMAN, constitute a challenge that has kept every key man and department head completely absorbed for the past tweny-five years.

There's a WEINMAN design that best does your pumping job. YOU and your WEINMAN representative should establish this important production link at the earliest opportunity. Together you can put all of your pumping operations on a paying basis. Write, wire or 'phone.

GENERAL SERVICE UNIPUMP



Because of its compact design the WEINMAN Unipump is extremely useful where installation space is limited. It is sturdily built and works against heads up to 500 feet at economical cost. Sizes up to 1000 G.P.M.

Built by Centrifugal Specialists

The Weinman Pump Mfg. Co

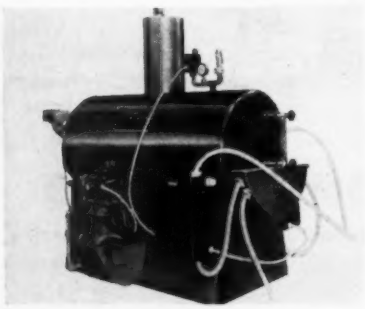
286 Spruce Street • Columbus 8 • Ohio

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 16)

319—ELECTRIC STEAM BOILER COMES IN 3 SIZES

Stationary, automatic electric steam boiler is ideal for producing either small or moderate amounts of steam up

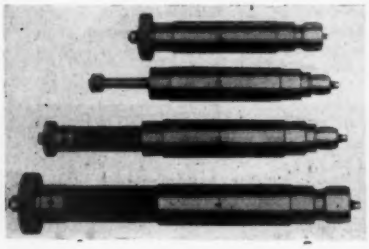


to full 90 psi. This boiler meets numerous requirements, and used as a steam cleaner it will handle two cleaning nozzles. The boiler is constructed in strict accordance with ASME specifications for working pressures up to 150 psi, and it will stand a 300 psi cold water test.

Very latest in completely automatic operation, this electric steam boiler is available in 40, 60 and 90 gal sizes. Boiler hp depends upon the number of elements ordered. Each element of 10 kw develops one boiler hp. Furnished in sizes as small as 1/10 up to a maximum of 10 hp. Siebring Mfg. Co.

320—GRINDER HAS FOUR SPINDLES

Precision grinding spindles, for use on all standard types of grinder, feature Fafnir bearing construction that permit high speed precision grinding operations. Uppermost spindle — type "H"—is designed especially for external grinding applications. The three lower spindles, types H-3, H5-1-½, and H5-2, perform a wide variety of internal grinding operations. Dimension "A" of all spindles is 2⅛ in., but it can be varied to meet the specific requirements of almost any grinder. Spindle "H" has grinding speed of approximately 3450 rpm when harnessed to normal power source, while the other three types can operate at speeds up to 30,000 rpm to meet individual job requirements.



Grinder has been designed specifically for attachment to engine lathes, planes and boring mills to facilitate precision external and internal surface finishing operations. Powered by ½ hp repulsion induction motor from any 110/220 v single-phase 60-cycle current source. Cable plug and switch are attached. The Maxwell Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

321—SCREW DRIVER HAS BUILT-IN FLASHLIGHT

A screw driver that lights up the head of a screw obscured by shadows or completely blanked out by darkness has been announced that contains a flashlight bulb, battery, and directional lucite lense. A perfect circle of bright light is thrown onto the work where needed and as long as desired. The flashlight operates by turning a knurled knob in the handle dome and will remain illuminated until switched off. This knob does not interfere with manipulating the screw driver.

The standard blade is of forged chrome Vanadium. A long-life bulb and regular pen light dry battery, both of which are obtainable at most drug, dime, hardware, and sporting goods stores, are easily replaceable.

Vaca amberyl flashlight screw drivers come in three convenient sizes. Model No. FL-24 has an overall length of 7-5/8 in. with a handle 1 in. x 3-5/8 in. and a blade 1/8 in. x 4 in. The No. FL-34 Model is 8-5/8 in. in length, with a handle 1 in. x 3-5/8 in., and a blade 3/16 in. x 5 in. for slotted screws, and No. PFL-1 with a 3/16 in. x 5 in. No. 1 Phillips bit for cross slot screws. Vaco Products Co.

322—MANEUVERABLE RAMP IS SAFE

One man can tilt the "Safe T Ramp" on its wheels and move it to any desired location. The 5 ft x 4 ft standard model is made of 3/8 in. thick steel

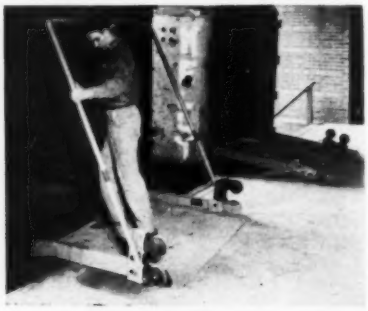
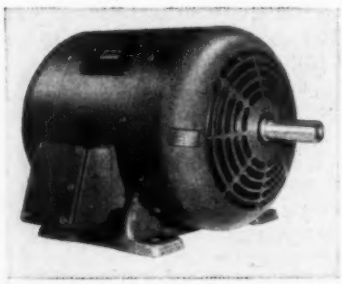


plate and weighs 450 lb. Because of the weight, it is not easily shifted by heavy loads. Safety is the most important feature of the "Safe T Ramp." It eliminates the hazards of handling heavy plates or the tipping of a load due to a buckled or shifting plate. The standard model will take up to 8 in. height differential—other models even greater elevation difference. G. A. Kleissler Co.

323—MOTOR FEATURES CORROSION RESISTANCE

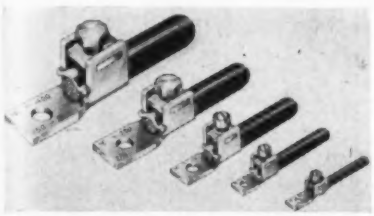


Motors, especially designed for applications where corrosive fumes and liquids are encountered, are available from Westinghouse Electric Corp. Frames, brackets, hoods and other exposed parts are alkali-cleaned, hot-water rinsed, then rinsed in chromic acid spray. After drying, they are sprayed with phenolic-alkyd-type enamel and baked. Additional protection is provided by a coat of gray enamel and two to four baked dips of thermoset varnish, followed by a final coat of gray lacquer.

Bronze split hub, clamp type blowers are employed for corrosion resistance. Rotating neoprene slingers on the shafts between rear brackets and hoods prevent the entrance of dirt or liquids into the bearing housings. Stator windings are double-dipped and baked in thermoset varnish. All hardware is dipped in slushing compound prior to assembly. The gasketed conduit box can be rotated to meet installation requirements.

324—LUG CONNECTORS COME IN 5 SIZES

Five lug models, comprising the "Wide Range" line of medium-priced pressure connectors for use with copper, aluminum or steel wire in sizes from 14 AWG to 500 MCM, are being marketed through electrical wholesalers by National Electric Products Corp. The "Wide Range" pressure



connectors are complete assemblies, thus eliminating all the loose washers or parts.

To provide strength for permanent maximum pressure, the tightening bolt, guide nut and contact pad are made of steel. Positive conductivity is said to be assured by the lug body being formed of hard-drawn electrolytic copper which also resists corrosion cracking. The entire unit is cadmium plated for corrosion as well as for oxidizing protection.

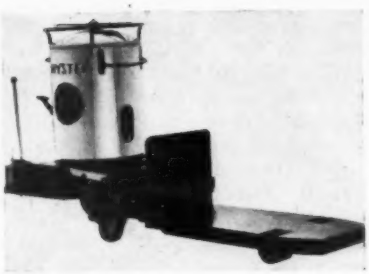
Each connector is said to be capable of handling a wide range of wire and cable sizes, thus creating low stock inventory.

The three smaller sizes, NE 35, 60 and 100 can be installed with a screwdriver; the larger sizes, NE 200 and 400, with a wrench. All sizes were made with minimum overall dimensions to expedite installation in small guttters.

325—TURRET TRUCK HAS 2 TON CAPACITY

Five models of trucks, formerly manufactured by the Salsbury Corporation and now taken over by the Hyster Company, include a turret line for horizontal materials handling.

Powered by a Wisconsin air-cooled engine, traveling up to eight mph when fully loaded, and highly maneuverable, each truck is equipped with the Salsbury fully automatic clutch and



transmission. The operator may either ride in a standing position or walk alongside, regulating speed by means of a throttle ring located inside the steering wheel. Turret trucks will handle almost any type of load up to a capacity of 4,000 lb.

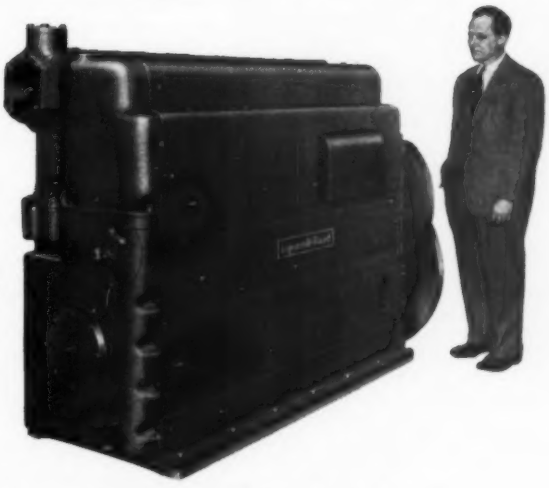
For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

326—LOAD CENTERS DESIGNED FOR MULTIPLE CIRCUITS

Load centers, that afford substantial savings in space and provide ample wiring room, are offered by Murray Manufacturing Corp. Models are designed for 2, 4, 6 or 8 circuits. Every

Only the

NEW IR DIESEL



195 to 375 horsepower

. . . gives big-engine features in a small package

Here's the smaller, lighter, more efficient, 4-cycle, supercharged heavy-duty diesel you've been waiting for . . . the TS engine. It's portable . . . but not automotive. Weighs only 30 lb per hp . . . yet operates at 900 to 1000 rpm. Consumes only 0.40 lb of fuel per hp-hr . . . yet has small, 7" by 8½" cylinders. Perfect balance . . . but no balancing devices.

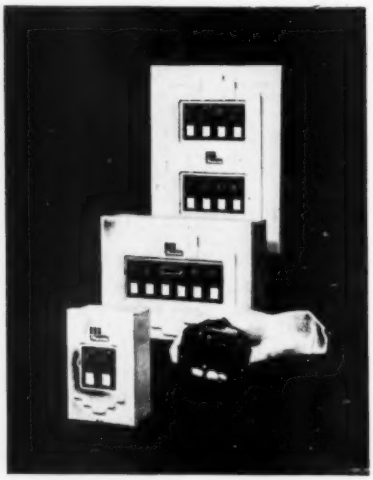
Compare the new Ingersoll-Rand TS with any other diesel for size, economy, and performance—and you'll agree it is the greatest advance in engine design in the past decade. Ideal for cranes, shovels, derricks, pumps, generators, and all types of stationary and portable applications. Send for complete information today.

Ingersoll-Rand 306-7

11 Broadway, New York 4, N. Y.

consideration has been given to ease of wiring and installation. Reduced depth of 3 in. permits flush installation in thin walls. Breakers of different ratings can be arranged in positions most convenient for connecting the particular circuits required on individual jobs. Breakers are available in ratings of 10, 15, 20, 25, 30, 35 and 50 amp.

Improved appearance of the load centers has been achieved by restyling the covers, which are made in both sur-

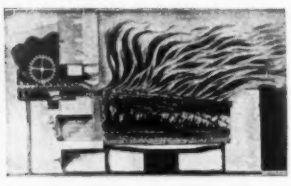


face and flush mounting types. Finished in neutral gray baked-on melamine enamel, they harmonize well with modern kitchens, play rooms, utility rooms or basements.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

327—"FIRE-OVER-FIRE" PRINCIPLE SAVES FUEL

Increased efficiency is obtained from the cheapest sizes of coal, wood (planer) chips and sawdust. An automatic "Fyr-Feeder" produces increased boiler capacity by spraying and burning the fines in suspension while spreading the larger pieces over the hot



fire on the grate. With this method solid fuels are automatically graded, with larger pieces falling near the front of grate and smaller pieces carried to the rear of grate.

Spreading solid fuels over the fire on grate by low pressure air, causes each piece of solid fuel to be surrounded by sufficient "over-fire" air to provide the necessary oxygen for perfect and immediate combustion. The manufacturer claims that the absence of clinkers has eliminated smoke and has reduced stoker maintenance to almost zero. Even steam pressure is maintained with never a shortage of steam. Fyr-Feeder Engineers, Div. of American Coal Burner Co.

328—COATING CAN SEAL MANY TYPES OF SURFACES

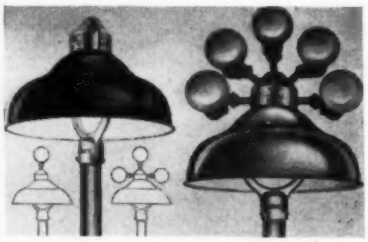
Corrosion and oxidation resistant coating is offered by End-O-Rust, Inc. Although primarily for metals, the sealing power adapts it with special success for use on concrete, wood, fibre or any surface where more than normal protection is needed. Location and laboratory tests reveal resistance against salt spray, caustic soda, ammonia, sulfuric, nitric, acetic, and hydrochloric acids.

No special preparation of surfaces is required. Quick drying is a notable characteristic, it will air dry for handling in 2 to 3 hr, force dry within 30 min, and infra red bake 3 to 5 min.

Product has a high hard gloss finish, impervious to abrasion, weathering and hard wear. It is especially recommended for coastal areas to withstand dampness, humidity or salt air.

329—OUTDOOR LIGHT HAS WATERPROOF CONSTRUCTION

A weatherproof column light has just been developed by Stone Manufacturing Co., for use where uniformly

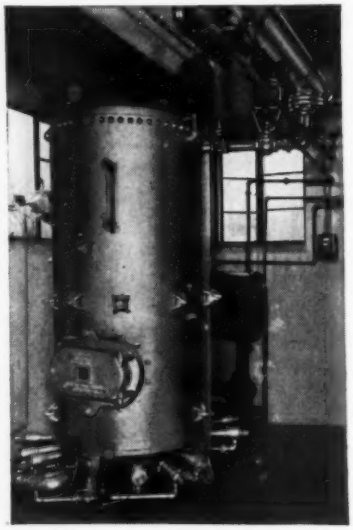


high lighting intensities are advisable or necessary over a wide ground area. The new area light has a heavy steel porcelain-enameled reflector, 20½ in. in dia, with a deep overhanging skirt to cut glare to a minimum. All wiring is fully enclosed inside a double-yoke hollow-arm construction that supports a built-in weatherproof cast aluminum splice box to which supplementary spots or floods can be added at any time.

The new unit is designed for normal base-up burning of 300 and 500-watt standard line lamps or for bi-post lamps in the 500, 750 and 1000-watt sizes. Supplementary cluster lights utilize either the 150-watt PAR-38 spot or flood, or the 300 and 500-watt sealed beam weatherproof reflector lamps.

330—WATER HEATING SYSTEM IS INSTANTANEOUS

Eclipse Fuel Engineering Co. offers a McKee storageless water heating system, that consists of an automatic



boiler, instantaneous water heater, steam control valve, thermostat, and a condensate unit.

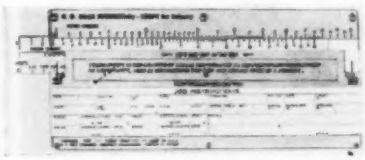
Advantages of the unit are—elimination of corrosion of tanks, coils or firing tubes; saving of fuel, as water is not heated until needed; space saving as needed for large storage tank is eliminated; uniform temperature of water all day; absence of scale formation in boiler as same water is used over and over again; elimination of rusty water, as tubes through which water flows are copper.

Economy has been demonstrated in field tests which showed considerably more gal of 180° water produced for each thousand of cu ft of natural gas than in previously used systems.

331—DEVICE INDICATES PRODUCTION RATES

R. G. Bock Engineers have designed a production control device that marks a significant step forward in simple, accurate productivity control. The Bock "Productivity-scope" is essentially a plastic unit with scales calibrated in terms of hours worked and hours earned, recessed for holding a "Job Instruction" slip, that can be attached

directly to each machine or placed on each worker's bench. When the hourly output is below standard, the fact is clearly indicated by a red signal. It helps to maintain projected profit margins on a given operation and increases labors earnings as well. When the job



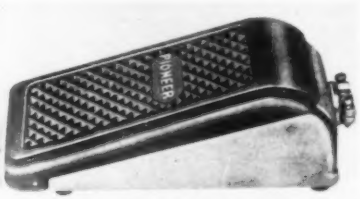
is in good shape with production above normal, the "Productivity-scope" shows a green signal.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

332—FOOT SWITCHES AID MACHINE OPERATORS

Foot switches give machine operators freedom of both hands; thus eliminating time-wasting, often dangerous hand movements, and help speed up production. They can be adapted for all types of power machines, photographic enlargers and for recorders and other electrical devices.

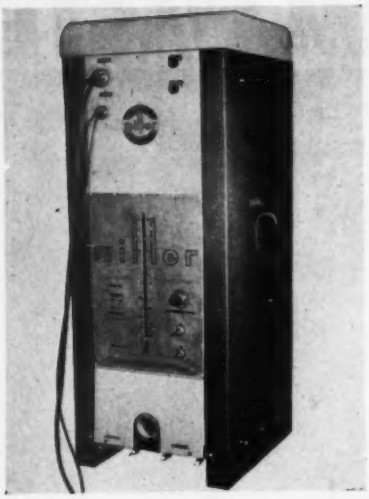
Model FS-50 is equipped with a BX clamp when a BX cable, Greenfield or other cord is run direct to the switch. The unit is rated 12 amp at 125 v or 6 amp at 250 v a-c/d-c. Another model, No. FS-40, is furnished complete with a heavy-duty cord and plug, and also a standard outlet. This switch is rated 10 amp at 125 v or 5 amp at 250 v a-c/d-c. Both of these models



are of the momentary-contact type. Switches are finished in attractive, two-tone crackle gray, with dark-red pedal. Pioneers Patents and Products Co.

333—A-C WELDER HAS FOOTSWITCH CONTROL

Field-tested hydraulic amperage control a-c arc welder enables the operator to make instant amperage changes without leaving the work and without

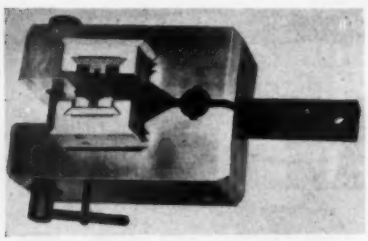


breaking the arc. The amperage can be changed from minimum to maximum within a few seconds, as slowly as the application demands. A reversible foot switch control is ideal for crater elimination and for amperage change by the operator when going from one thickness of metal to another. The heat can be reduced quickly or slowly. The control feature also enables the operator to start with a lower heat on thin gauge material (eliminating the possibility of a burn through) and then increase the heat as desired.

The welders are supplied in three amperage ranges—10 to 200 amp, 10 to 400 amp and 10 to 700 amp—in either "A" or "B" models. The "A" models have two foot switches. Miller Electric Mfg. Co.

334—HONING MACHINE ACCURATE TO .0001

A series of honing tools for sizing and finishing external diameters, announced by Sunnen Products Co. can be used with all metals, all hardnesses, fill needs in production, tool room, salvage, and maintenance departments, in a range between 1/8 to 2-3/4 in.



Among the outstanding advantages claimed are precise geometric accuracy, correction of "clover leaf" patterns (often produced by centerless grinding), and avoidance of "washout" caused around ports and lands by lapping processes. These hones not only produce perfectly round diameters, but also correct "rainbow" warpage caused by heat treat distortion. Dimensional accuracy can be obtained to within .0001 in. Construction features include a machined aluminum housing, micrometer feed-up, fingertip control, and a steel arm to absorb honing torque.

335—LIFT TRUCK HAS MANY FEATURES

Broadening of the Service Motowlift line of fork lift trucks to include heavy-duty models of advance design in the 4000 and 6000 lb capacity class is announced by Service Caster & Truck Corp.

The unit is powered with a 6-cylinder industrial engine of 226 cubic in. displacement, which provides a reserve even under the most gruelling road conditions.

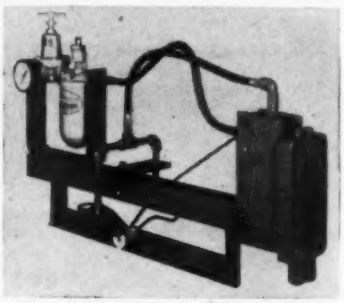
A heavy-duty integral drive axle and constant mesh transmission by Timken is provided, together with a special Borg-Warner clutch that can be replaced in two hours without removing engine or transmission.

The carriage has mast channels formed from 3/4 in. extra strength steel and is equipped with eight hardened, anti-friction rollers. The two lifting chains have a strength of 24,000 lb each. A variety of lifting heights is available.

336—AUTOMATIC LUBRICATOR FOR T-BEAM CONVEYOR

Lubricator automatically lubricates bearings in 1¼ in. dia wheels which run on a T-beam. Center distance between wheels is 16 in. Wheels have roller bearings which must be oiled frequently and automatically.

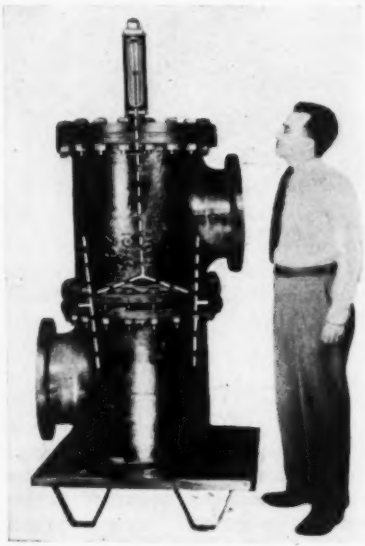
Four nozzles direct oiled air jets to both the inside and outside of each wheel bearing. Conveyor speed is ten fpm. Operation is entirely automatic. As each pair of trolley wheels passed the lubricator, they trip triggers which release jets of oil fogged air directly into the wheel bearings. A regulator with back mounted gage is used for establishing a proper operating pressure of approximately 40 psi. Air pressure, volume of lubricant, direction and timing of "shot" are subject to easy adjustment. J. N. Fauver Co., Inc.



For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

337—FLOW METER ADAPTABLE FOR PLANT-WIDE SERVICE

Three basic units in standard pipe tees plus indicating, controlling, recording or telemetering instruments provide complete plant-wide flow measurement. Flow rates from 2 to 6200 gpm and from 3 to 12,500 cfm are handled with a minimum number of basic metering parts designed for installation inside standard pipe fittings. Mountings for indicators, controllers, recorders, integrators and telemetering instruments are interchangeable in all sizes. Suitable for liquids, gases, pulps and slurries, these meters permit plant-wide flow-measurement standardization at low cost. Fischer & Porter Company.



338—SLING AND CHAIN ARE ENGINEERED

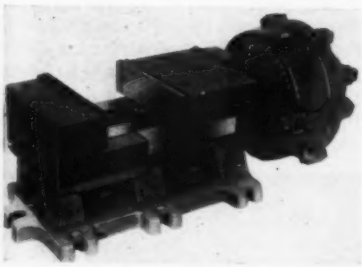
Made especially for trunions and other foundry uses these hooks eliminate hand make-up. The items are stress engineered—much safer than the hand-made type—and forged into a round at the point for easy insertion in holes in castings. They are furnished as an integral part of complete ACCO endweldur registered sling chains.

Hooks are of the same material as the sling chain. The entire sling assembly is proof tested from bearing point to bearing point. These units

come completely assembled. American Chain Div., American Chain & Cable Co., Inc.

339—MACHINE VISE OPERATED BY AIR

An air operated machine vise—Model 811—has been added to the "Vi-Speed" family manufactured by the Van Products Company. The device can be actuated with air between



the limits of 15 to 150 psi.

Overall dimensions are 24-3/4 in. long, 10½ in. wide, and 9½ in. high. Maximum opening of jaws is 11 in. with an air stroke of 4 in. The unit is fully adjustable, and play from long or heavy usage can be taken up without dismounting. The jaws close quickly, and when released snap open. Working power is from 0 to 5 tons.

340—"T" SLOT-BOLTS PROVIDE 50% MORE SURFACE

To meet the high strength requirements of the service in which they are used, Crayton T-slot bolts are forged from Timken (SAE 4140) steel, machined to precise dimensions, hardened and long drawn in an isothermic

Unistage

RESULT OF

50 Years of Dependable Service

Model 105 *Unistage* Compressor on base with Motor, horizontal air receiver and cooling unit.

FOR PRODUCTION and MAINTENANCE
FOR SPEEDY PNEUMATIC TOOLS

SCHRAMM INC. offers a complete line of Industrial Compressors in sizes ranging from ... 2 to 600 cubic feet displacement... Built and designed for continuous heavy duty service with a minimum of attention.

Available in "V" or Flat Belt Drive ... on base for belt drive from motor or engine ... or, with direct motor drive. No special foundation required ... can be bolted to any substantial floor.

Where running water is not available the SCHRAMM Cooling Unit will prove adequate under severest conditions. Accessories essential to any modern industrial installation can also be provided.

Write for Bulletin = 4910.

Important Features

Compact... Easy to Install
Mechanical Intake Valve
Force Feed Lubrication
100% Water Cooled
Electric Push Button Starting
En Bloc Construction
Easy Accessibility
Vibrationless
More Bearing Surface

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

quench. The design provides 50% more bearing surface on the T-slot and, in addition, the head will clean the slot as it passes through.

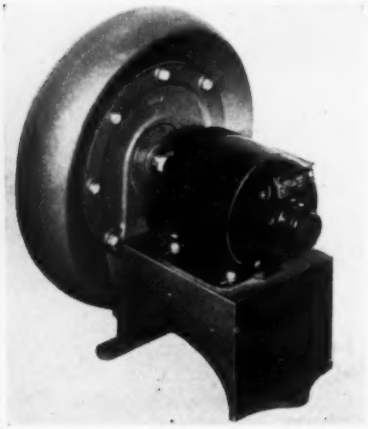
CRAYTON T-SLOT BOLT

T-bolts are available in 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4 and 1 1/2 in. dia and in various lengths from 1 to 30 in. The length specifies the distance the bolt projects out of the slot, rather than the full length of the bolt. Each bolt is stamped with diameter and length for the convenience of the user. Bolts are economical to use because of their low initial cost, increased life and their time-saving features. T. M. Crayton.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

341—GAS BOOSTERS COME IN 15 SIZES

Single - stage, direct - connected gas pressure boosters made by the Bryant Industrial Div. of Affiliated Gas Equipment, Inc. come in fifteen sizes. Gas pressure can be raised from 3 in. water column to as much as 46 in. water column. Capacity of the boosters ranges from 3,800 to 86,000 cu ft of gas per hour. Choice of the proper unit for a particular service and gas gravity is simplified through use of comprehensive selection tables. The boosters are designed for continuous operation at full load, and to offer no resistance to the free flow of gas when not under power.



Units come with outlet pipes set to any one of seven tangential positions, and subsequent changes may be made in the field with little difficulty. Square-flanged fittings eliminate the need of unions in connecting lines.

342—PROTECTIVE HOOD HAS BEEN RUBBERIZED

Coated with a recently improved rubber, the fabric in the G-S safety hood is impervious to moisture, most acids, caustics, oils, and solvents and protects against extreme temperature and light metal splashes. In addition, flexibility is retained for long, durable life.

The G-S rubberized hood is fitted

with a large plastic window for easy visibility and protects the worker's face, head and neck from dangerous sprays or splashing while working on acid storage tanks or pipe lines, degreasing, pickling, enameling, paint spraying, sand blasting and similar operations. May be worn with goggles or respirator. General Scientific Equipment Co.

343—POWDER ACTUATED TOOL DRIVES STEEL STUDS

Positive and easier automatic firing-pin action with no misfires or delays are the advantages of the Mine Safety Appliances Company's powder-actuated tools for driving steel studs into metal, concrete or masonry. The tools are widely used to install electrical equipment, pipe and duct hangars, metal door frames and other fixtures.

Feature of the "MSA velocity-power driver" is a spring-impelled firing pin that virtually eliminates the "human factor" in firing a stud-cartridge unit. The arrangement is positive in action, yet safe and tamper-proof.

The operator must push the tool forward to fire the stud-cartridge, but the speed and force of the forward motion are not important to the operation. Built-in safety features of the tool have not been affected by design change. Before the cartridge can be fired, a spring-loaded safety arm in the handle has to be rotated 180° and held in that position. Therefore, the cartridge cannot be discharged if the tool is dropped because the safety arm holds the firing pin away from the primer until it is rotated. Even if the firing pin spring is cocked, the pin will not contact the primer until the safety arm is rotated.

344—OUTDOOR HANGER ELIMINATES LADDERS

The Thompson Electric Company has developed four new all-aluminum unit packages for all types of outdoor lighting installations. These unit packages contain a complete Thompson disconnecting & lowering hanger, a lighting fixture adapter (for either pendant or yoke-type fixtures), a slip-fit elbow, bracket end, U-bolts, filler blocks, a fixed position corner pulley, a specified length of galvanized chain, and (optional) an open-type lock box with a spring-loaded terminal link or a fully enclosed, pulley-equipped lock box for use with conduit enclosed ver-

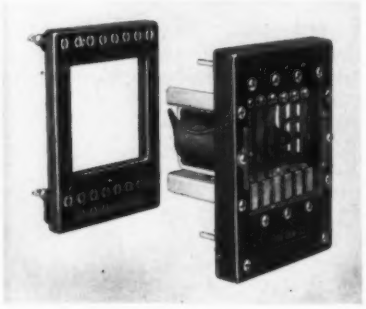
tical chain runs. The enclosed lock box is weather and tamper-proof.

Applications are for industrial plants, switch yards, parking zones, loading docks, shipping platforms, and air-

ports. They facilitate continuous safe, easy lighting fixture maintenance and provide for maximum lighting efficiency at remarkably low cost.

345—RELAY HAS LONG LIFE

Relays built for long life (100 million operations, minimum) at high-speed incorporate many features not found in the average relay. For example: contacts do not pile up, instead, six single-pole double-throw contacts are arranged side by side to provide 28 different contact combinations. Con-



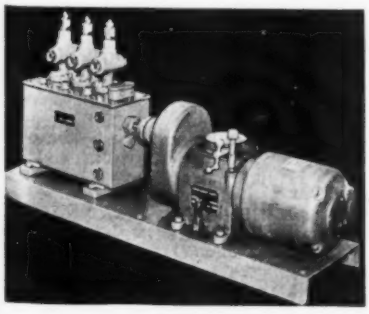
tacts are not bent to provide pressure as a coiled beryllium spring in the face of the core presses against the back of the armature to provide the needed pressure.

Connections are not soldered to the contacts—the individual contacts and prongs are of one-piece construction, and each contact provides its own prong for jack-connecting to the circuit. All contacts are fully protected. Coils can be furnished for 24 to 150 v d-c. The Autocall Co.

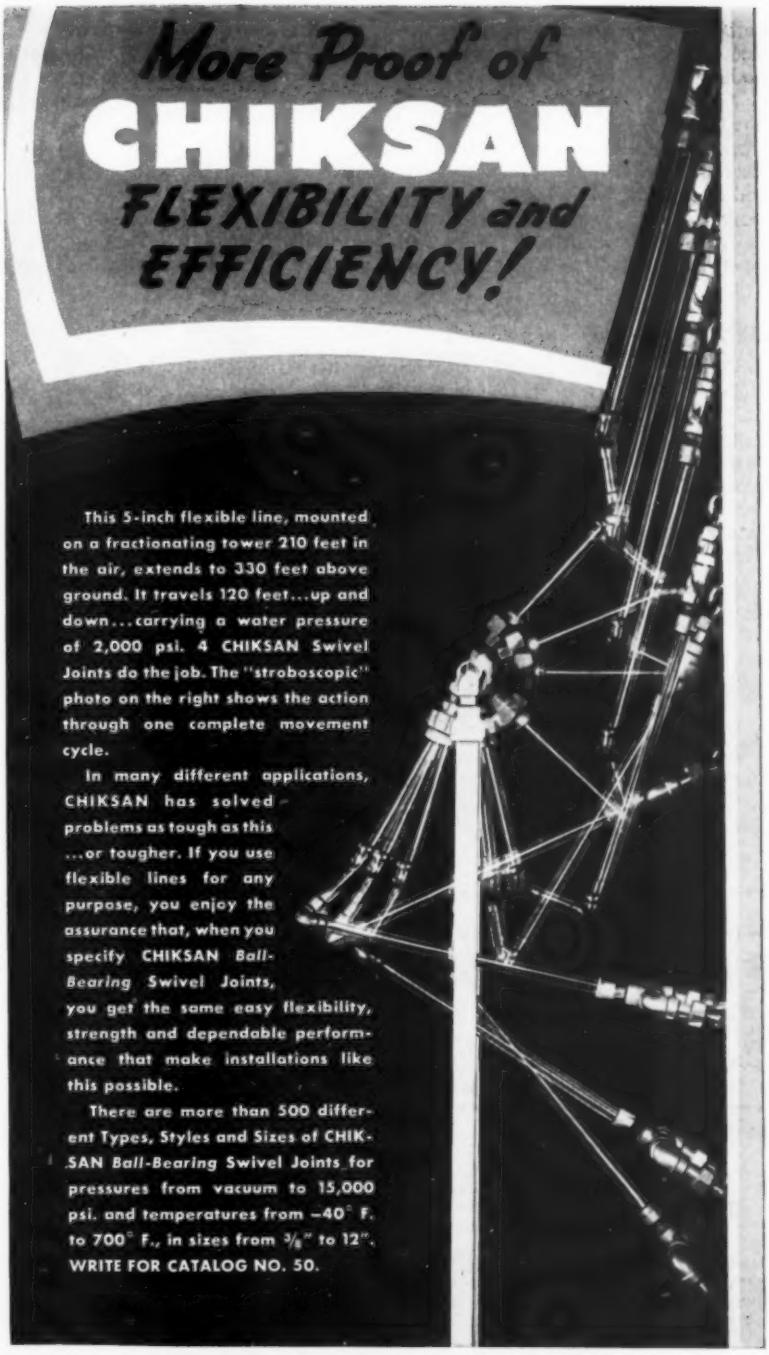
346—CHEMICAL FEEDER CAN OPERATE AGAINST 300 PSI

Manzel Div. of Frontier Industries Inc., announces a chemical feeder capable of pumping against pressures of 300 psi per feed. The unit is adjustable up to one gpm per feed.

Multiple units may be supplied with



any number of feeds, operated by rotary, motor, or lever drive. Pumping units may be constructed of various ma-


More Proof of
CHIKSAN
FLEXIBILITY and
EFFICIENCY!
This 5-inch flexible line, mounted on a fractionating tower 210 feet in the air, extends to 330 feet above ground. It travels 120 feet...up and down...carrying a water pressure of 2,000 psi. 4 CHIKSAN Swivel Joints do the job. The "stroboscopic" photo on the right shows the action through one complete movement cycle.
In many different applications, CHIKSAN has solved problems as tough as this ...or tougher. If you use flexible lines for any purpose, you enjoy the assurance that, when you specify CHIKSAN Ball-Bearing Swivel Joints, you get the same easy flexibility, strength and dependable performance that make installations like this possible.
There are more than 500 different Types, Styles and Sizes of CHIKSAN Ball-Bearing Swivel Joints for pressures from vacuum to 15,000 psi. and temperatures from −40° F. to 700° F., in sizes from 3/8" to 12". WRITE FOR CATALOG NO. 50.

The location of this flexible line, at the top of the fractionating tower, demands dependable performance with minimum maintenance attention. CHIKSAN Ball-Bearing Swivel Joints meet these requirements fully.

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SOLD BY LEADING SUPPLY STORES EVERYWHERE

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CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

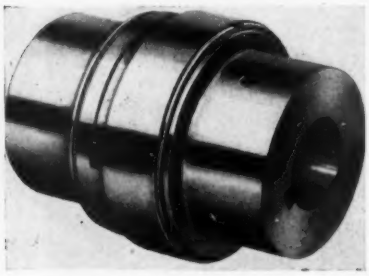
BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

terials to meet special requirements in food, chemical, petroleum, and other industries.

Equipment is similar in operation to the other Manzel chemical feeders, automatically injecting the chemical in exact proportion to the amount of liquid being pumped. Only the pumping unit comes into contact with the chemical, as the entire driving mechanism operates in an enclosed oil filled case.

347—COUPLING FEATURES EASE OF INSTALLATION

Improvements were made in type "C" and "H" couplings to assure easier installation and larger bore capacities. Inside sleeve is made in two parts instead of one, which provide a sleeve for each body. Both bodies are machined alike for removable steel collar. The bodies are interchangeable, and it is easy to put the collar on either half of the coupling. Collar is held in place by snap-ring, instead of bolts as formerly. Lovejoy Flexible Coupling Co.



348—WELDING SHIELD HAS PERISCOPE

Industrial Products Co. announces a specialized welding shield designed for getting into offset or close places where the welder cannot normally see to make the necessary weld. The device is comprised of a fibre shield to which has been adapted a form of periscope. A true picture is given with no reverse effect as experienced when using individually placed mirrors.

Welding glass is on the inside where it is protected and is instantly turned out of the way of vision by means of a conveniently located trigger operated by the index finger of the same hand in which the shield is held. Welding glass automatically returns to welding position when trigger is released. Length, including the handle 18 in.

349—GRAVITY OILERS HAVE IMPROVED CONTROL

Ratchet control, spring mechanism with protecting cap locks the adjustment into position and avoids changing the rate of feed while cleaning or from vibration.

Dual-purpose vent relieves suction and back pressures and provides an overflow when feed is set too fast. Oil supply is clearly visible through a shatter-proof plastic reservoir. Oiler is 50% lighter, has self-closing, dust proof filler cap and is plated. It is available in 1, 2, 4 and 8 oz capacities; ⅛, ¼ and ⅜ in. pipe thread. Trico Fuse Mfg. Co.

NEW BULLETINS

(Continued fom page 21)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 37.

Level Price List (VV) Handy tabular reference style price list, covers a complete line of levels. Length, style number, number of vials and shipping weight are given under the individual heading for each of the many types manufactured. Price lists are now available in a choice of two sizes: regular folder size (8½ x 11) and catalog binder (11⅝ x 11¾). The E. A. Stevens Level Co.

Locknuts and Lockwashers (WW) Specifications and dimensional charts for a new line of locknuts and lockwashers, designed for locking ball and roller bearings on shafts, has just been released in a four page bulletin. Shaft sizes covered are ⅜ to 8 in. Shafting machining data are given in table form for ⅜ to 8 in. bore. Link-Belt Company.

Disc Files (XX) Specifications are listed and typical mountings are shown in a two page folder presentation of disc files. The files are suitable for use on brass, bronze, and numerous alloys. Recommended speeds for four file sizes are included in table form. Kennametal Inc.

Tube Cleaners (YY) Tube cleaners for all purposes are described in a new 28-page illustrated bulletin. Applications cover tube cleaners for removing scale and other types of encrustation from tubes or pipes in boiler room equipment, oil refineries, and process plant. Various types of motors, cutter heads, drills, brushes, operating hose, and couplings are fully described. Many helpful hints are offered on the care and operation of tube cleaners. Elliott Company, Lagonda Division.

VALVES, PIPING AND FITTINGS

Glass Specialties (ZZ) Precision-bore glass specialties, the products of a unique glass-forming process are shown in a published catalog. Illustrated and described are precision-bore round, square and capillary tubing for use in high-accuracy barometers and manometers, burettes, and other precision glass apparatus. Fischer & Porter Co.

Swivel Pipe Coupling (AAA) Catalog describes the design features, gives complete specifications, working pressures and prices of its complete line of high-pressure and low-pressure ball bearing swivel pipe couplings. Eight basic styles, in sizes from 3/8 to 12 in. and for pressures from vacuum to 12,000 psi are discussed. Information on the following products are included: steel rotary hose, steel cementing hose, mud mixing guns, marine and barge hose and steel circulating heads. Gil-Lair Products, Inc.

Lift-Plug Valves (BBB) Attractive 16-page color bulletin covers all the features on a line of non-lubricating lift-plug valves manufactured by this company. Sectional views—in color—illustrate featured details and explain operating principles. Outline dimensions and parts pictured for assembly included. Cameron Iron Works, Inc.

Valve Selection Chart (CCC) A handy new reducing valve selection chart has just been released in conjunction with a reducing valve bulletin. The chart helps to determine proper valve sizes, and clearly indicates which valves are suitable for dead-end service and which are not. In many cases valve users will specify for dead-end service valves, which are not tight closing. The valves thus chosen prove to be unsatisfactory and often dangerous to the users. Klipfel Valves, Inc.

HEATING, VENTILATING AND AIR-CONDITIONING

Pressure Tanks (DDD) Bulletin on pressure tanks for airblasting is now available that describes tanks operating continuously and intermittently. Pictures and detail drawings are included. The tanks are convenient, semi-portable and ideal for high and low pressure blast cleaning, for cutting

monument inscriptions, and for similar work. American Wheelabrator and Equipment Corp.

Dust Control (EEE) How all the savings of dust control can be initiated, in even an industry so plagued by dust as in foundries, is the story told in a new folder titled "Foundry Dust Control...and 'Sand Conditioning" Typical installations are explained and illustrated. Aquadyne Corp.

Wall Radiation (FFF) Six-page folder gives complete information on a line of wall radiation heating equipment. Three styles are explained and illustrated. Capacity tables are included for steam and hotwater radiation per lineal ft for each style. Fedders-Quigan Corp.

Electrostatic Precipitation (GGG) Two-color 16 page bulletin on electrostatic precipitation is profusely illustrated with photographs and diagrams. The publication explains how electrostatic precipitation works, gives case histories of seven typical installations, where the system is being used, and describes the various methods of electrostatic precipitation and the electric equipment applicable to each method. General Electric Company.

MISCELLANEOUS

Plant Lighting Guide (HHH) Concise 32-page planned lighting guide covers the latest concepts of planned lighting, the benefits to be gained and the methods to employ to put a planned lighting program into effect. The guide breaks the problem into three major parts: economics, program development and equipment selection. Benjamin Electric Mfg. Co.

Lubrication Data Book (III) New booklet, entitled "Data Book No. 1-50" contains valuable information on the subject of lubrication. It should prove of considerable interest to those in charge of operating and maintaining mechanical equipment. Numerous tables, pertaining to viscosity, specification of greases and recommendations are included. Fiske Brothers Refining Co., Lubriplate Div.

Heat Absorbing Glass (JJJ) How to increase productivity and lower maintenance costs in industrial and other buildings through the use of heat absorbing and glare reducing glass, is detailed in a new 12-page catalog. Typical applications in factories are illustrated and important facts covering the heat absorbing and glare reducing properties of the glass, confirmed in experiments conducted by an independent testing laboratory are presented. In addition to heat and light transmission tables, the catalog also contains complete specification data. Mississippi Glass Co.

Rust Proofer (KKK) Pamphlet describes this company's reputed product "1000 plus one uses" in industry. The text explains how this material can be applied over rust without wire brushing or scraping and how it penetrates and seals the surface, effectively preventing further rust action. Clear, colorless form for use as a primer or base coating it resists temperature changes, moisture, industrial chemicals and gases and is also ideal for underwater and marine use. Speco, Inc.

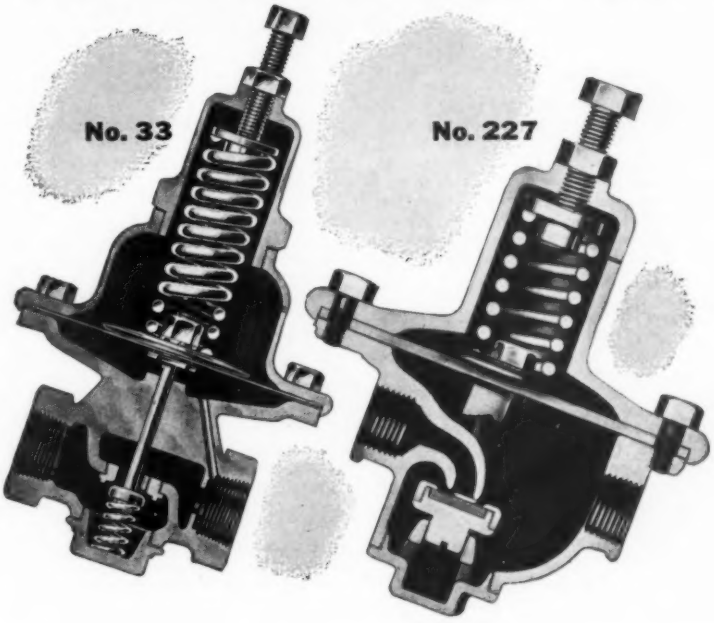
Stop Losing Money

in Pressure Reducing . . .

USE

MASONEILAN

PRESSURE REGULATORS



Masoneilan Reducing valves make a hit with production and maintenance men in all types of industries because they furnish economical pressure control. Their dependable operation, low maintenance cost and minimum time-out-of-service saves money through accurate control and reduced waste.

No. 33 for steam and air service — Sizes from ⅛" to ¾". Reduced pressure ranges 2-20; 20-40; 40-100 psi. Maximum working pressure 200 lbs.

No. 227 for water service — Sizes ¼" to 2". Reduced pressure ranges 10 to 60 psi. Maximum working pressure 150 psi. Also available for air service from ¼" to 1".

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Charlotte, N. C.

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MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

Stoker Manufacturers' Association—The annual meeting of the stoker group will be held in Chicago at the LaSalle Hotel on Thursday, June 15. This is a change in the date originally scheduled for this meeting. The original basic plans remain the same, however, to hold a one-day business meeting with a separate technical conference. This conference will be held in the morning simultaneously with a closed executive session of manufacturer and associate members.

The afternoon will be devoted to a speaking program featuring talks by sales and merchandising specialists and by representatives of allied industries. A general open-forum on the industry's most pressing and critical problems is also being planned.

Other events on the day's busy program will include the annual banquet, meetings of the retiring and new board of directors, and meetings of special committees.

Inquiries concerning this meeting should be addressed to Marc G. Bluth, executive secretary, Stoker Manufacturers Association, 307 North Michigan Avenue, Chicago 1, Ill.

MIT, Plastics Committee—Plastics and their mechanical properties as viewed from the standpoint of research, engineering, and architecture will be the subject of a three-day conference at the Massachusetts Institute of Technology on June 20, 21, and 22, 1950.

Sponsored by the MIT Plastics Committee, the program will provide an opportunity for those interested in but not directly associated with plastics to hear and participate in discussions of their many properties and uses. Research workers in the field will report their findings for discussion by others engaged in research as well as by engineers involved in plastics applications.

Professor A. G. H. Dietz, department of Building Engineering and Construction, is chairman of the conference's sponsoring committee. Other faculty members on the committee include: Professor E. A. Hauser, chemical engineering; Professor W. M. Murray, mechanical engineering; Professor E. R. Schwarz, textile technology; and Professor W. S. Stockmayer, chemistry.

The schedule of papers to be given at the conference is as follows:

Tuesday, June 20, 1950:

The Theory of Visco-Elastic Behavior in High Polymers, by Turner Alfrey, Polytechnic Institute of Brooklyn.

Static and Dynamic Properties of Rubber-like Materials, by E. Guth, University of Notre Dame.

Reaction of Polymers and Mechanical Waves, by W. O. Baker, Bell Telephone Laboratories.

Mechanical Properties of Plastics at Ultrasonic Frequencies, by W. P. Mason, Bell Telephone Laboratories.

The Usefulness of Basic Mechanical Properties in the Evaluation of Plastic Materials, by R. Buchdahl and L. E. Nielsen, Monsanto Chemical Co.

Mechanical Properties of Linear Amorphous Polymers, by R. D. Andrews, Princeton University.

Wednesday, June 21, 1950:

Flow Markings in Polymeric Solids, by Waller George and George Irwin, Naval Research Laboratory.

Injection Molding of Polystyrene, by R. S. Spencer, Dow Chemical Co.

Complex Stressing of Polymers, by I. L. Hopkins, Bell Telephone Laboratories.

Origin and Interpretation of Fracture Markings in Plastic Materials, by J. A. Kies, Naval Research Laboratory.

Flow and Fracture Characteristics of Polymethyl Methacrylate, by W. J. Gailus, Massachusetts Institute of Technology.

Creep and Relaxation Properties of Polymethyl Methacrylate, by Steven Yurenka, Massachusetts Institute of Technology.

The Effect of Molecular Weight Distribution on the Stress-Strain Properties of Polymethyl Methacrylate, by Earl Patterson, Massachusetts Institute of Technology.

The Effect of Orientation of Molecules on the Mechanical Properties of Polystyrene, by R. G. Cheatham, Massachusetts Institute of Technology.

Thursday, June 22, 1950:

Mechanical Properties of Rigid Plastics, by Robert Burns, Bell Telephone Laboratories

Evaluating Mechanical Properties of Polyethylene and Other Non-rigid Plastics, by R. H. Carey, Bakelite Division, Union Carbide and Carbon Corp.

Plastics-based Laminates, by G. H. Clark, The Formica Co.

Engineering Adhesives, by F. M. Reinhart, National Bureau of Standards.

Protective and Decorative Industrial Finishes, by M. R. Euverard, Interchemical Corp.

Synthetic Textiles in Automobiles, by N. J. Rakas, National Automotive Fibers, Inc.

Films and Coated Fabrics, by L. Boor, Philadelphia Quartermaster Depot.

Resistance of Plastics to Various Service Conditions, by G. M. Kline, National Bureau of Standards.

National Instrument Conference—Fifth National Instrument Conference and exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18-22, 1950. Five days of technical sessions of the following participating Societies will be conducted in the Auditorium in connection with the Conference. The Instrument Society of America, American Institute of Physics, Industrial and Regulators division of the ASME, Institute of Radio Engineers, Instruments and Measurements Committee of the AIEE and National Telemetering Forum.

The Instrument Exhibit will occupy 15500 sq ft and will include scientific and industrial instruments and devices for measurement, inspection, testing and automatic control. The latest developments in instruments will be on display to the expected 7500 visitors.

MIT, Industrial Waste Conference—Three-day New England Industrial Wastes Conference on June 26, 27, and 28, will be a feature of the 1950 summer session at the MIT held in joint sponsorship with the department of Civil and Sanitary Engineering, the New England Council and the New England Sewage Works Association. Professors Rolf Eliassen and Clair N. Sawyer represent the MIT sanitary engineering laboratories on the committee in charge of the conference.

Professor Walter H. Gale, director of the MIT summer session, described the conference as part of a broad series of summer activities scheduled during 1950 to make the Institute's special facilities available to those in industry and technology who cannot participate in its regular program.

The Industrial Wastes Conference, according to Professor Eliassen, will be designed to bring together these three groups for discussion of water pollution and control problems: (1). Industrialists, representing management, chemical engineers, and sanitary engineers, (2). Representatives of stream pollution and water control agencies, including federal, regional, and state, and (3). Research workers and consulting engineers concerned with industrial wastes and water supply problems.

In addition to general discussions of pollution abatement from the viewpoints of industry, control agencies, and municipalities, there will be symposia on the water and waste problems of specific New England industries, including pulp and paper, wool scouring, cotton and wool dyeing and finishing, metallurgy and metal working, and leather tanning.

Industrial Relations—Five intensive, full-time conferences on specialized aspects of personnel administration and industrial relations will be conducted next July by the Industrial Relations Section, California Institute of Technology in Pasadena, Calif.

The conferences scheduled are: July 9 to 14—Re-examining a Pension Program; July 9 to 14—Wage and Salary Administration; July 16 to 21—Managerial Development; July 16 to 21—Re-examining Insurance and Other Benefit Programs (other than pensions); and July 23 to 28—Communication Between Management and Employees.

Each conference is designed for executives responsible for the development and administration of the program to be discussed. Attendance is limited in order to permit full discussion and exchange of experiences.

The conference leaders include: Lee Laird, manager, Benefits division, Standard Oil Co. of Calif.; Russell L. Moberly, director, Industrial Management Institutes, University of Wisconsin; Paul Pigors, associate professor of Industrial Relations, Massachusetts Institute of Technology; John W. Riegel, director, Bureau of Industrial Relations, University of Michigan; Leo Wolman professor of Economics, Columbia University, Member, Re-

search Staff, National Bureau of Economic Research; and Robert D. Gray, director, Industrial Relations Section, California Institute of Technology.

First Annual Houston Industrial Exposition—May 10-14, the Coliseum, Houston, Texas. Ed. G. Lenzner is General Manager. Scientific instruments, equipment and machinery for industrial plants, manufacturing plants, chemical plants, refineries and oil drilling and production equipment will be exhibited. The Exposition is a nonprofit corporation operated by industry itself for industrial, technical and scientific advancement and will present extensive displays of the most modern designs in tools, machinery and equipment as well as the newest developments in metals, plastics, chemicals and allied materials.

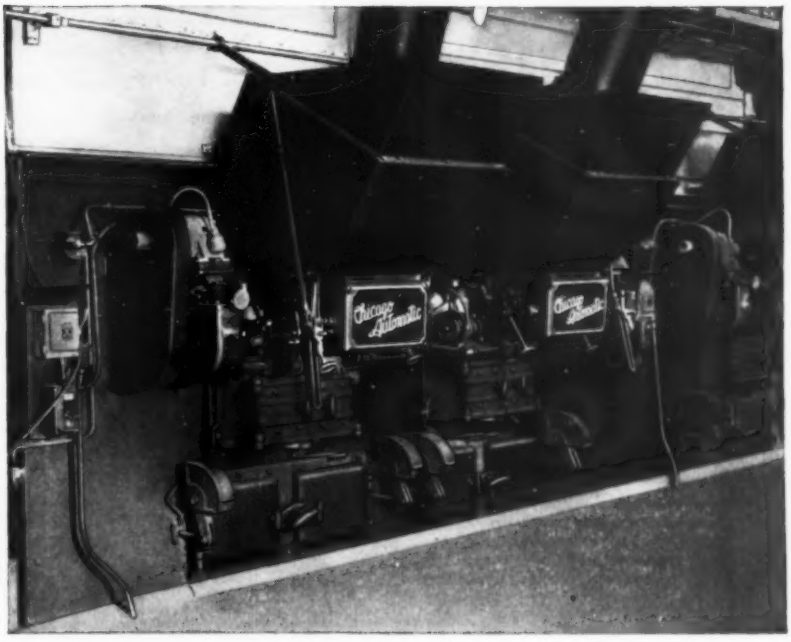
Society For Experimental Stress Analysis—Spring Meeting, May 25, 26, and 27, Hotel Statler, Cleveland, Ohio. Details of meeting can be obtained from the Society for Experimental Stress Analysis, P. O. Box 168, Cambridge 39, Massachusetts.

Wisconsin Power Conference and Exposition—June 7, 8 and 9, Hotel Schroeder, Milwaukee, Wisconsin. Cosponsored by the Wisconsin State Association of the National Association of Power Engineers and the Associate Engineers and Supplymen of Wisconsin: Walter W. Roock, secretary, 3430 W. Forest Home Ave., Milwaukee 15, Wisconsin. Subjects to be covered will include: Economic and operating comparisons of coal, oil, and natural gas; boiler water conditioning; refractories; electricity; pumps; heating and ventilating; plant maintenance and plant safety.

Institute of Northwest Resources—Second Annual Meeting, June 19-30, Oregon State College, Corvallis, Ore. Prof. J. Granville Jenson is Coordinator for the Institute. The two week institute will feature some twenty outstanding authorities on Northwest regional resources development and utilization in daily seminar discussions on selected topics currently of urgent importance to the Northwest. Opportunity will be provided for teachers, business, civic and professional leaders to become better informed on the state of Northwest regional development and with the plans now being carried forward by existing agencies. Critical analyses for interpreting regional development propositions such as the CVA will be presented. Field trips for observation of resource utilization will form an outstanding part of the two weeks session.

U. S. Technical Conference on Air Pollution—May 3, 4, and 5, Wardman Park Hotel, Washington, D. C. Dr. Louis C. McCabe, chief of the Bureau of Mines Office of Air and Stream Pollution, is in charge of plans for the conference, which will comprise seven panel meetings to consider the numerous problems arising from air contaminants and ways of solving them. Panel subjects are:

Meteorology, Health, Instrumentation, Equipment, Analytical Methods and Properties, Legislation and Agriculture.



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BOOK REVIEWS . . . . *Here are the latest books from the publishers lists reviewed for your convenience in selecting the ones that will meet your needs in a variety of engineering, plant equipment and related subjects*

Electronics Dictionary

"A Dictionary of Electronic Terms," edited by H. L. Van Velzer Ph.D. Published by the Allied Radio Corp. 833 West Jackson Blvd., Chicago 7, Ill. Illustrated. 64 pages. 25 cents.

This publication, edited by Harry L. Van Velzer, Ph.D., Associate Professor of Electrical Engineering, University of Illinois, answers the need for an accurate, up-to-date reference source of words used in the rapidly expanding electronics field.

Definitions cover mostly modern techniques and equipment, but range from many words no longer in general use, retained for historic reasons, to the new language of color television and the electronics of nuclear physics.

Over 125 illustrations and diagrams of components, equipment, and electronic circuits are included, as well as an appendix section containing useful radio data.

Printed in handy 6 x 9 in. format, this new dictionary should prove very helpful as a reference guide for engineers, industrial electronics specialists, research men, service men, experimenters and students.

NEMA Switchgear Standards

"NEMA Standards for Power switchgear Assemblies," Publication No. SG5-1950. Published by the National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y. 64 pages. $4.00.

This is a complete revision of the NEMA Standards for Power Switchgear Assemblies, Publication No. 44-92. It covers the rating, testing, manufacturing and application of assemblies of switchgear devices such as switches, interrupting devices and control, metering, protective and regulating equipment with associated interconnections and supporting structures. Information concerning standard equipment, abbreviations, device numbers and symbols, and instructions for the installation, operation and care of power switchboards is also given in this publication. The terms used throughout the standard are defined.

Report Writing

"Practical Report Writing," by Selby S. Santmyers. Published by International Textbook Co., Scranton, Pa. 118 pages. $2.75.

Clearly outlined instructions, on basic thinking and actual preparation of reports, show how good business reports can be formed to help a man finish his work and go ahead in his job. Selby S. Santmeyers, the author, has been an industrial consultant and training supervisor for such firms as General Electric, Westinghouse and General Motors. His book first shows the importance of reports and the background needed by the report writer. It deals with gathering and organization of material, and with shaping the rough draft. In such A-B-C fashion, the author goes on to show how to polish the business report so that it becomes a clear cut instrument for doing a job.

In his eyes, the business report, written with an economy of words and a fullness of ideas, is just as essential to the industrial job as the design and pattern of a company's product. The language is simple and down to earth. Check lists and marginal notes on sample reports give the reader a working guide and a permanent reference work in an important but too often neglected phase of business.

NEMA Marine Steam Turbine Standards

"NEMA Standards for Marine-propulsion Steam Turbines and Gears, Publication No. MP4-1950. Published by the National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y. 8 pages. $1.00.

New NEMA publication contains standards covering marine-propulsion steam turbines and gears. It also includes corresponding standards for such values as ratings, speeds, direction of rotation, "K" factors, normal power, maximum power, astern capacity, standard throttle steam pressure, allowable pressure variation, allowable temperature variation, number of extraction openings and performance.

In addition, the publication lists standard accessories, standard spares and standard tools. It also gives other information of value to the operating company, the naval architect and the ship builder in selecting standard equipment to meet his requirements for marine-propulsion equipment.

Welding Handbook

"Welding Handbook, Third Edition." Published by the American Welding Society, 33 West 39th Street, New York 18, N. Y. Illustrated. 1650 pages. Cloth bound. $12.00 in United States and Canada; $13.00 elsewhere.

Third Edition of the Welding Handbook has just been published by the American Welding Society making available to everyone interested in welding the most complete and authoritative up-to-date single volume on welding.

Third edition contains 65 chapters covering the more than 30 welding and cutting processes in use by industry today, the welding of ferrous and nonferrous metals and alloys, and the application of welding in different industries. Also included are individual chapters on cost estimating, welding metallurgy, physics of welding, a dictionary of welding terms, general engineering tables, welding symbols, filler metal specifications, inspection, and many others. A bibliography is included at the end of each chapter listing the important codes, standards, books and technical articles on the subject of the chapter for those seeking further information.

More than 300 tables are included in the Handbook to make it useful for ready reference and illustrations are generously used to show welding equipment, welding details and specific applications. The 69 page index makes it possible to readily find specific information and related information contained in different chapters. Both the index and the text are extensively cross-referenced. Items in the index have been grouped by welding processes, by metals, by applications and have been further grouped under engineering headings such as design, workmanship, inspection, etc. Each item is also separately listed in alphabetical order.

Instrumentation Papers

"Proceedings of the Annual Meeting 1949," Engineering College Research Council of the American Society for Engineering Education. Published by the Engineering College Research Council, State University of Iowa, Iowa City, Iowa. Illustrated. 140 pages. $2.00.

Symposium of twelve papers on instrumentation for engineering research and proceedings of the 1949 annual ASEE meeting describe federal military and non-military engineering research interests, as reported to the Research Council by research executives in the Army, Navy, Air Force, Public Health Service, Highway Research Board, N.A.C.A., and the Department of Agriculture.

The symposium on instrumentation contains, in addition to an important paper on instrument engineering by professors G. S. Brown and D. P. Campbell of M.I.T. and H. T. March of the M. W. Kellogg Co., descriptions of a number of new mechanical and electrical instrumentation devices developed in industrial and college laboratories.

Volume on proceedings opens with an important statement on research policies and goals of colleges and universities by A. F. Spilhaus, Dean of the Institute of Technology, University of Minnesota. In addition to all papers given in the 1949 Annual Meeting of the Research Council at the Rensselaer Polytechnic Institute, the book includes official reports of the council's activities in 1948-49.

Minerals Yearbook

"Minerals Yearbook 1947." Published by the Superintendent of Documents, Government Printing Office, Washington 25, D. C. 1600 pages. $4.25.

Authoritative information on domestic and foreign mineral commodities compiled annually by the Bureau of Mines, is now available for public distribution.

Containing 1,593 pages of basic data for the year 1947, the mineral industry's peak year of production, the Yearbook records the output, distribution, and consumption of all known mineral commodities. It is expected to be of considerable assistance to businessmen, legislators, Government officials charged with administering national security and other programs, and to the general public.

Written and edited by commodity specialists in the Bureau of Mines, the 1947 Yearbook contains four main di-

visions: General, Commodity, State, and Foreign Reviews, and includes a comprehensive index. Preprints of certain portions or chapters may also be obtained.

Various commodities are alphabetically arranged and comprise 64 chapters, from "abrasives" to "zinc," and including platinum, gold and other precious metals, and gems as well as uranium, petroleum products, coal, and carbon black. In the section devoted to foreign minerals, special emphasis is given to the mineral industry of the Latin American countries.

Nomogram Guide

"An Index of Nomograms," by Douglas P. Adams. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 174 pages. $4.00.

Joint publication of Wiley and the Technology Press of the Massachusetts Institute of Technology gives the location and content of 1700 alignment diagrams published etensively in current technical journals. Emphasizing the use of nomograms—graphical devices designed to yield quick, accurate solutions to mathematical formulae—in practical engineering problems requiring the repeated use of the same equation. The index covers a wide range of fields. Among these are: chemistry and chemical engineering; mathematics physics; electricity, electronics and radio; hydraulics and power; aeronautics; waterworks and sewage; illumination; heating, piping and ventilating; oil and gas; building and surveying; mining; machine tools and design; metals; textiles; medicine; food; and transportation.

Douglas P. Adams, the editor, is associate professor of graphics at Massachusetts Institute of Technology and a visiting lecturer in engineering sciences at Harvard University.

Wrought Steel and Iron pipe Code

"Wrought Steel and Wrought Iron Pipe B36.10—1950." Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. 65cents.

This 1950 Code conforms to usage which has followed piping made to commercial dimensions instead of those equivalent to schedule wall pipe as shown in the earlier edition. The contents contains: List of specifications for pipes with ASA designations, and titles of standards specifications; tables of weights and thicknesses listed by scheduled numbers, of which the lightest wall is 10S and the heaviest is 160S; tables of weights and thicknesses listed as standard, extra strong, and double extra strong walls; sizes and wall thicknesses common to all tables are shown in bold face.

Handbook on Hydroelectrics

"Hydroelectric Handbook," edited by W. P. Creager and J. D. Justin. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1151 pages. Illustrated. $12.50.

Completely revised edition of the well-known "Hydroelectric Handbook," edited by William P. Creager and the late Joel D. Justin is now available for distribution.

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inal 1927 version, the new form provides engineers with current and practical data on the design and construction of all types of hydroelectric plants, dams, and irrigation projects. Specifically covered in the forty-four authoritative, up-to-date chapters are such topics of concern to hydroelectric engineers as power costs, hydraulics, estimating stream flow, powerhouses, conduits, turbines, and generator installation.

In preparation since 1939, this edition can be considered the most modern treatise on the subject. Engineers in all kinds of hydroelectric activity can now have at their very fingertips all the latest advances made in their profession during the past ten years. The new reference work will be useful to civil and electrical engineers whose professional activities and interests may bring them in contact with hydroelectric projects.

For the new edition of their handbook, the editors called upon eighteen other authorities on various phases of hydraulic engineering practice to contribute appropriate material covering their specialties.

Letter Symbols

"Letter Symbols for Aeronautical Sciences Z10.7-1950." Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

First American standard covering letter symbols for aeronautics and aerodynamics was prepared by subcommittee No. 7 of the sectional committee on letter symbols and abbreviations for use in science and engineering. Symbols and quantities are given in two listings; the first listing being alphabetical by symbols and the second alphabetical by concept. For users convenience, an alphabetical index by concept is included. In the concluding sections, recommended designations are given for forces, moments, and coefficients.

Welding Terms

"Standard Welding Terms and Their Definitions". Published by the American Welding Society, 33 West 39 Street, New York 18, N. Y. Illustrated. 52 pages plus charts. $1.00.

Booklet, which has been in work for over three years, contains up-to-date information on definitions and terms applied to the welding industry. The terms have been grouped alphabetically in the first section of the publication. The second section is compiled of 57 well-explained illustrations of all welding methods, types of joints, and welding cycles for each weld.

This booklet will prove invaluable for designers, planners and the shop men, who are engaged in actual welding of equipment.

Business Handbook

"Business Executive's Handbook," Second Edition, by Brown and Doris. Published by Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. Illustrated. 1600 pages. $7.50.

Second edition of this publication contains up-to-date information on 7700 items pertinent to business and business problems. The handbook is a one-volume "self-advancement" library that offers information in 17 different fields of business practice.

Some of the subjects covered are: the dollars and cents of business; better letter writing; helpful facts about advertising; managing salesmen; how to manage an office; financial statements; business insurance; corporate meetings, minutes and resolutions; and partnerships. The book will prove invaluable to executives and men who maintain responsible positions in their organizations.

Fully indexed, the book gives the answers to business "know-how".

Electronics

"Electronics—Principles and Applications," by Ralph R. Wright. Published by The Roland Press Co., 15 E. 26th Street, New York 10, N. Y. Illustrated. 387 pages. $5.50.

Basic electronic fundamentals, for non-electrical engineering students and an excellent reference source for the electrical graduate, are contained in a newly written book. The author has made the text flexible so it can be suited for many curricula now offered in engineering colleges.

Make up and arrangement consists of three parts. The first three chapters present the basic principles of electronics; the fourth chapter is a review of a-c and d-c circuits; while the remaining eight chapters deal with the application of electronic tubes.

Feature subjects in the book are: electron behavior; vacuum tubes; gas tubes; principles of circuit analysis; amplification; rectification; high-frequency heating; and basic control circuits.

Transactions

"1949 Transactions." Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y. Illustrated. 1400 pages. Cloth bound. $15.00.

The 159 expertly written technical papers and discussions in this volume make available an invaluable fund of engineering information on major developments and researches of the past year in the following specialized phases of mechanical engineering: applied mechanics, aviation, fuels, gas-turbine power, heat transfer, hydraulics, industrial instruments and regulation, lubrication, machine design, metal cutting, metals engineering, textiles, oil and gas power, petroleum, production engineering, power railroad, railroad, textiles, and wood industries.

Plant Maintenance Problems

"Techniques of Plant Maintenance—1950." Published by Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y. 278 pages. $2.00 both volumes.

Publication covers the most comprehensive discussion of problems of plant maintenance ever undertaken by the management of the Plant Maintenance Show which was held in Cleveland, O. The two-volume text is the proceedings of the first Plant Maintenance Conference held concurrently with the show.

Thirty outstanding experts in various fields of maintenance led the conference and about 8,000 executives concerned with plant maintenance attended. The two volumes comprise 278 pages, 8½ x 11, and include 47 pages of tables, diagrams, illustrations, graphs and charts. Five hundred and fifty-four questions submitted by the audience are answered in the second volume.

Subjects covered include maintenance organization and principles; maintenance costs and budgeting; selection and upkeep of lighting equipment; upkeep of motors, controls and distribution equipment; use of electrical instruments in maintenance; upkeep of floors, walls and roofs; relationship of lighting and color to production; sanitation and housekeeping; lubrication; application of service equipment; protection of plant and worker, and the importance of maintenance to safety.

Welding Design

"Design for Welding," published by the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. Illustrated. 1000 pages. $2.00 in United States; $2.50 elsewhere.

Book composed of abstracts from 82 award papers, selected and edited by Professor R. S. Green, for the purpose of making available a record of representative welded design. Emphasis has been placed on projects produced and in operation, that have proved satisfactory. The book contains alibera presentation of cost data on the various designs, which afford a sound means of making a comparative study of methods.

Liberally illustrated throughout, the book is devided into nine well defined sections, which are as follows: (1) aircraft, (2) automotive, (3) railroads, (4) watercraft, (5) containers, (6) furniture, (7) structures, (8) machinery and (9) weldenes. The section on structures covers buildings, bridges, and miscellaneous structure; while the section on machinery includes over 30 different types of machines and parts.

Boiler Code

"1949 ASME Boiler Construction Code." Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

Indispensable reference for those who design, construct, install, inspect and use boilers and pressure vessels. The Code is issued in the following nine sections with all changes and additions of the past three years incorporated in its pages: Power Boiler Code Including Rules for Inspection (Section I and VI), $2.75; Material Specifications (Section II), $5.00; Boilers of Locomotives (Section III), $1.00; Low-Pressure Heating Boiler Code (Section IV), $1.00; Miniature Boiler Code (Section V), $.75; Suggested Rules for Care of Power Boilers (Section VII), $1.25; Unfired Pressure Vessel Code (Section VIII), $2.25; and Welding Qualifications (Section IX), $.90.

Industrial Relations Trends

"Trends in Industrial Relations," Bulletin No. 16. Published by the Industrial Relations Section, California Institute of Technology, Pasadena 4, California. Illustrated. 90 pages. $1.00.

Publication covers the important papers delivered at a special conference on "Profitable Personnel Policies" in

observance of the tenth anniversary of the Industrial Relations Section of California Institute of Technology.

Contained in the bulletin are seven papers, headed by an introduction which explains the aims and personnel responsible for the conference. The following papers are included: Management's Responsibilities for Personnel Policies, by Alexander R. Heron; The Labor Outlook, by Leo Wolman; What's Ahead in Industrial Relations, by Lawrence A. Appley; The Role of Universities in Industrial Relations, by Dale Yoder; Caltech's Industrial Relations Section, by Lee A. DuBridge; As I View Caltech's Industrial Relations Section, by Lawrence A. Appley; and Ten-Year Report, by Robert D. Gray.

Electrical Instrument Manual

"Manual of Electrical Instruments." Published by General Electric Co., Schenectady 5, N. Y. Illustrated. 150 pages. When ordering specify GET-1087A. $1.00.

Revised edition of GE's "Manual of Electric Instruments" describes the fundamentals of construction and operating principles of all major types of electric instruments.

Prepared primarily for use in schools, the manual also is designed for men in industry who wish to become familiar with the electric instruments with which they work. Its thirteen chapters explain the fundamentals of such instruments as thermocouples, synchroscopes, frequency meters, and electric telemeters. The 150 pages are extensively illustrated by photographs and diagrams. An added feature of this library-type textbook is a full reference index.

Hacksaw Blades

"Simplified Practice Recommendation R90-49, Hacksaw Blades," by the Commodity Standards Division of the National Bureau of Standards. Copies obtainable at 5 cents each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

The recommendation, which was originally issued in 1928, established a simplified list of stock sizes of hacksaw blades. Broach blades have been omitted from this edition, and the remaining types of blades, covered in tables 1 to 5 of R90-46, have been consolidated into two tables: Table 1 covering handframe sizes, all-steel types, and Table 2 covering power sizes, high-speed-steel type only.

Centrifugal Pumps

"Engineering Papers of Hydraulic Institute", volume II, published by Hydraulic Institute, 90 West Street, New York 6, N. Y. Illustrated. $2.00.

This volume contains the following papers, winners of awards in contests sponsored by Hydraulic Institute for employees of its members: "Cavitation in Centrifugal Pumps", by A. J. Stepanoff; "The Centrifugal Pump in the Process Industries", by A. T. Nielsen; "The Operation of Centrifugal Boiler Feed Pumps", by Hans Gartmann; and "Submergence for Centrifugal Condensate Pumps", by Hollis T. Waldo.

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NEWS . . . of men and companies

The Fluor Corporation, Inc.—The following promotions of personnel have been made by the Fluor Company—designers, engineers, constructors and manufacturers of the oil, gas and chemical industries.

J. G. DeFlon

L. Weidlien

James G. DeFlon, engineer with Fluor since 1941, has been assigned duties in Fluor's New York sales office. This is following his return upon completing details of the company's agreement with Head Wrightson Processes Ltd., in London, England. The agreement between the two companies paves the way for the sale of Fluor products and services in the Sterling and other European areas. DeFlon reports that Fluor cooling tower jobs are already under way for British Petroleum Chemicals in Grange Mouth, Scotland; for Philbloc, Ltd., at Avon Mouth, England; and for Socony Vacuum at Gravenchon, near Le Havre, France.

Lee Weidlien, engineer for Fluor in their Los Angeles sales office from 1943 to 1948, recently rejoined the company to take charge of sales in Fluor's San Francisco office. Mr. Weidlien has spent many years in the industrial field as a sales engineer.

Jack E. McKay, well-known advertising manager for Fluor in their main plant at Los Angeles, was advanced to the position of sales engineer in Fluor's Houston sales office. A graduate of the University of Oklahoma, McKay joined Fluor in 1942. Prior to his position as manager of advertising and public relations, he worked for the company as a sales engineer in Kansas City and Los Angeles.

J. E. McKay

R. H. Morse, Jr.

Fairbanks, Morse & Co.—The third generation Morse became president of Fairbanks, Morse & Co., on March 22, 1950. Robert H. Morse, Jr., who started with the company in 1916 in the foundry of the Beloit, Wisc., plant, was elected to the presidency by the directors, following the annual meeting of stockholders.

Mr. Morse has been vice president in charge of operations. Previously he was vice president in charge of sales, assistant general sales manager and has held many other positions.

His father, Colonel Robert H. Morse, whom he succeeded, becomes chairman of the board. Colonel Morse has been president since 1931 and has spent 55 years with the company.

His Grandfather, Charles Hosmer Morse, was the founder of the company and was chairman of the board upon his death in 1921. It was in 1847 when he bound himself out for $50 a year to learn the scale business with the firm which later became the present company.

Mr. Morse is also President of the Diesel Engine Manufacturers Association.

Allis-Chalmers Mfg. Co. — Appointment of R. S. Stevenson as general sales manager of the Allis-Chalmers Tractor division has been announced by W. A. Roberts, executive vice-president of the company. Mr. Stevenson succeeds Marshall L. Noel who recently resigned for personal reasons and whose resignation, the company announced, was accepted with regret.

Mr. Stevenson has been associated with Allis-Chalmers since 1933 when he joined the Kansas City branch as a salesman. Two years later he became assistant manager of the company's branch at Omaha, Nebraska. In 1936 he was transferred to the Milwaukee home office as assistant Southwest territory manager, and later that year was appointed manager of the Northwest territory, which includes the northwestern states and western Canada. In 1941 Stevenson was appointed Southwest territory manager, remaining in that position until the fall of 1948 when he became assistant general sales manager.

During the past seventeen years, Mr. Stevenson's work has kept him in constant touch with the company's field organization and its industrial dealers. His field experience has given him a broad understanding of equipment usage and a general knowledge of the entire tractor industry. His constant contacts with dealers and customers in construction equipment fields assures an understanding of their problems and a desire to serve their equipment requirements.

Borg-Warner Corp. — All manufacturing and administrative activities of the Marvel-Schebler Carburetor Division of Borg-Warner Corp., now located in Flint, Mich., will be transferred to Decatur, Ill., in the late summer or early fall of this year.

Marvel-Schebler is one of the nation's largest producers of precision-made carburetors for the agricultural implement industry as well as for other general industries.

Physical limitations of the Flint plant, which made expansion impossible, dictated the necessity for the move, according to S. W. Gray, President of the Marvel-Schebler Division. Negotiations are in progress for the sale of the Marvel-Schebler plant in Flint to E. I. DuPont de Nemours and Co.

National Association of Engineering Companies.—Announcement has been made of the recent election of officers in the NAEC for the 1950 fiscal year. The following men were honored:—president, Harry L. Murray, Murray Engineering Co.; vice president,—Walter W. Schmitt, Product Engineering Service, Inc.; secretary-treasurer,—Walter R. Jackson, Modern Engineering Service Co.

Mr. Murray, still in his 30's and recognized as a leader in tool specialty engineering, received recognition for his work on the Public Relations Committee in formulating NAEC's unique index of national engineering services.

NAEC also announces the election of three new directors to terms expiring March 1953: Albert F. Lehmann, Special Engineering Service, Inc.; William H. Bosserman, Bosserman-Pearce Engineering Company; and Walter R. Jackson.

Link-Belt Co.—Link-Belt has just announced that Mr. David E. Davidson was elected vice-president for sales, with headquarters at executive offices, 307 N. Michigan Ave., Chicago 1.

Mr. Davidson, a mechanical engineering graduate of Armour Institute of Technology (now I.I.T.), has been general manager at the company's Pershing Road plant, Chicago, since 1947. He entered the employ of the company's Caldwell plant, Chicago, in 1924 in the shop.

D. E. Davidson

E. P. Berg

Successively, he served as draftsman in various branches of the engineering department at both the Caldwell and Pershing Road plants; sales engineer at Atlanta plant; district sales engineer at Detroit warehouse; district sales manager at Indianapolis; assistant chief engineer at Pershing Road, and later general manager.

Mr. Eugene P. Berg, formerly assistant general manager, has been appointed general manager of the Pershing Road plant, to succeed Mr. Davidson.

Mr. Berg, a mechanical engineering graduate of Purdue, began his Link-Belt career by working in the Pershing Road shop during vacations, 1929 to 1937.

He has successively served as supervisor of the methods department at Pershing Road; general foreman of the steel shop; works manager at the company's Philadelphia plant; general superintendent at Pershing Road, and then assistant general manager.

The Babcock & Wilcox Tube Co.—The appointment of C. B. Marshall, Jr., to the sales force of the Chicago district sales office of The Babcock & Wilcox Tube Company, was announced today by L. E. Jeanneret, manager of sales, welded tube division.

Mr. Marshall is a graduate in chemical engineering from Washington and Jefferson College, Washington, Pa. Since 1944 he has been in the general sales office of The Babcock & Wilcox Tube Company's welded tube division at Alliance, Ohio, and until recently was manager of the general sales office there. Prior to associating with the company, Mr. Marshall had been with Hall Laboratories, Inc., Pittsburg, Pa., and was later connected with the National Works of the National Tube Co. at McKeesport, Pa.

C. B. Marshall, Jr.

M. H. Miller

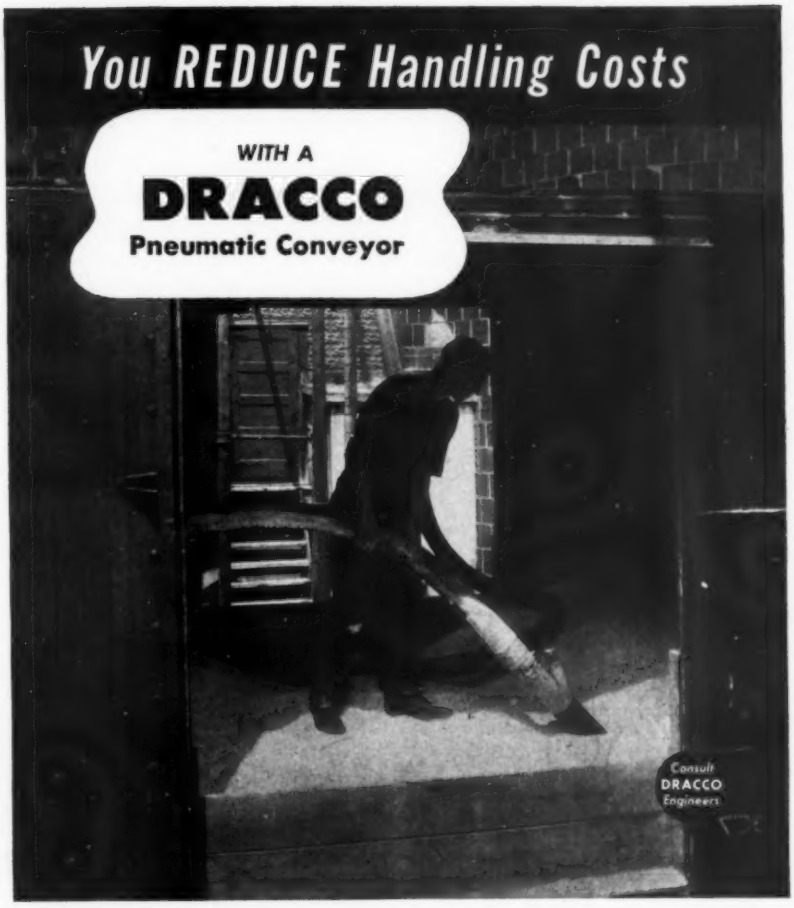
The National Supply Co.—Martin H. Miller has been made Plant Controller of Superior Engine Division, Springfield, Ohio. He will coordinate all financial functions of the Springfield plant. After joining The National Supply Company in 1934, he held, successively, the positions of cost clerk, chief cost clerk, and budget supervisor. In 1949 he was made Superior Engine division office manager.

Chase Brass & Copper Co.—The appointment of Melvin C. Harris, of Pittsburgh, Pa., to the position of works manager of the Cleveland, Ohio, mills of Chase Brass & Copper Co., Incorporated, has been announced by Robert L. Coe, president of Chase.

Mr. Harris succeeds William F. Aylard in that capacity, Mr. Aylard having been made chief engineer of the company.

For the past 34 years, Mr. Harris has been associated with Allegheny Ludlum Steel Corporation, at Pittsburgh, and was vice-president in charge of operations at the time he accepted this new post with Chase.

Mr. Aylard has been with Chase since his graduation from Case Institute of Technology in June, 1933. Until January, 1945, most of his employment was concerned with the research departments, but at that time he was appointed assistant plant manager. A year later he was made general superintendent and in October, 1947, was promoted to works manager.



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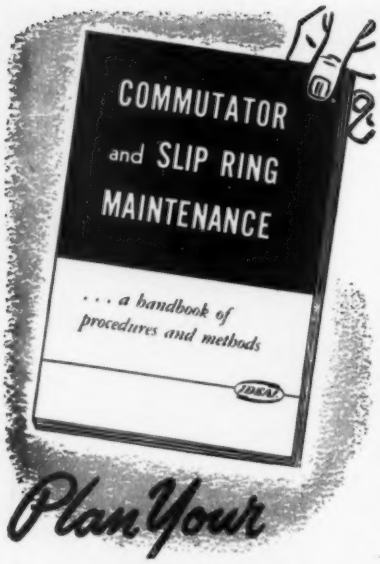

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Illinois Engineering Co.—At the annual meeting of the board of directors, James C. Matchett was elected president and treasurer; Gordon L. Harris, vice president and assistant treasurer; and L. B. Carlson, secretary.

Robert L. Gifford who has served as president and treasurer of the Company since its incorporation in 1900 is now chairman of the board.

Mr. Matchett, a member of ASH&VE and ASME, is well known in the industry having joined the company in 1912. He has served as vice president and general manager since 1923.

Mr. Harris, identified with the Company since 1910, has been secretary since 1923.

The Company, now celebrating its 50th year, has representatives in 60 cities of the United States and in foreign countries.

The Hydraulic Press Mfg. Co.—J. C. Poole was recently promoted from assistant purchasing agent to director of purchases. He has been associated with H-P-M for a number of years and through his previous capacity is thoroughly familiar with the company's purchasing requirements.

Mr. Poole started with H-P-M as assistant personnel manager and was later made assistant purchasing agent and personnel manager. He was appointed assistant secretary in 1948. Prior to coming with the company he served in the U. S. Navy as Lieutenant (senior grade) and spent three years in the European Theatre of operation. Before entering the Navy he was associated with Jones and Laughlin Steel Corporation, Aliquippa, Pennsylvania.

In addition to his purchasing activities, Mr. Poole will retain his position as assistant secretary of the company.

The Colorado Fuel and Iron Corp.—It was announced today by Mr. Carl W. Meyers, president, that at the last meeting of the board of directors, Mr. F. S. Jones was elected vice president in charge of sales for The Colorado Fuel and Iron Corporation, effective April 1, 1950. Mr. Jones will succeed Mr. Newell H. Orr who has retired but who will continue in an advisory capacity.

Mr. Jones came with CF&I in 1908. He began selling in Hutchinson, Kansas, as a combination fuel and steel salesman in 1913. Since then he has

STUDIES WEATHER-FORECASTING TECHNIQUES WITH MASS SPECTROMETER

Scientist of the Geophysical Research Directorate, a branch of the Air Force Cambridge Research Laboratory, recently announced that information being obtained by means of an instrument called the "analytical mass spectrometer," will be used in new studies of the composition of the earth's atmosphere. The studies, they explained, may lead to the development of new weather-forecast techniques. J. C. Neuland is shown here seated before the control panel of the instrument. The mass spectrometer is a development of General Electric

held managerial positions in most of the company's territory, occupying offices in Grand Junction, Salt Lake City, Oklahoma City and Denver.

The position previously occupied by Mr. Jones, that of general manager of commercial steel sales of the western division, will be filled by James N. Counter, advancing from Rocky Mountain division sales manager.

Mr. Counter, a native of Denver, has filled several district managerships during his services with CF&I—Amarillo, El Paso, Phoenix, and Salt Lake City, and later the Denver district.

United States Steel Corp.—Harold A. Miller is the new sales personnel division manager in the general sales department of United States Steel supply company, a U. S. Steel subsidiary. He will have offices in the company's headquarters in Chicago.

Since 1947, Mr. Miller has been assistant in the sales personnel division of United States Steel Corporation of Delaware in Pittsburgh. Prior to holding this position he was associate personnel director of Antioch college, Yellow Springs, Ohio.

H. A. Miller

E. G. Schroeder

The Electric Products Co.—G. J. Berry vice president in charge of sales announced the appointment of E. G. Schroeder to the position of sales manager. Previously Mr. Schroeder was field sales manager, and prior to that position, district manager of their Detroit office. Mr. Schroeder has a broad industrial sales background.

A graduate electrical engineer of Renssaeler Polytechnic Institute, Mr. Schroeder was associated with the New York Electric and Gas Corp. and the General Electric Co. before joining the Electric Products Co. in 1945.

Caterpillar Tractor Co.—Promotion of five men to key positions in the new earthmoving equipment plant under construction at Joliet, Ill., is announced by T. R. Farley, vice president and general manager of the Joliet project.

Hubert D. Baggs, superintendent of the steel fabrication factory in Peoria, has been named factory manager at Joliet. Walter J. Gottschalk, insurance manager in the industrial relations department at Peoria, will become personnel manager at the new plant. Robert A. Morgan, currently manager of office methods and procedures in the accounting department at Peoria, will assume the responsibilities of chief accountant at the Joliet plant.

W. G. Schuller, assistant purchasing agent at Peoria, has been selected as purchasing agent for the Joliet operations. Otto F. Wiesemann, scheduling division manager in the production di-

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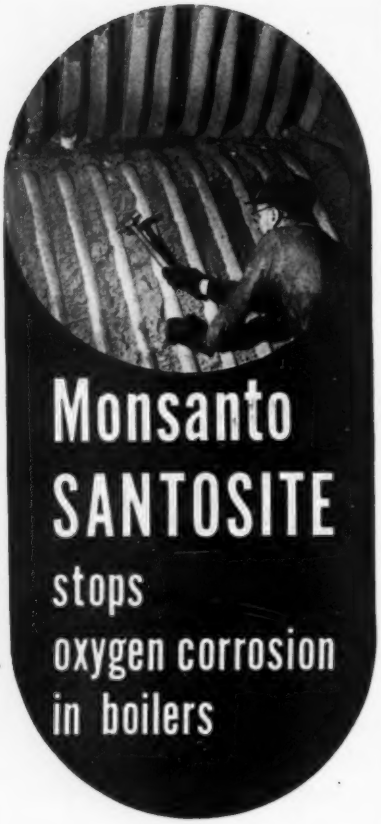

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vision of the manufacturing department, will be production division manager at Joliet.

With advancement of Mr. Gottschalk to personnel manager at the Joliet plant, E. E. "Jim" Garrison becomes insurance division manager at Peoria.

Edwin L. Wiegand Co.—This manufacturer of Chromalox electric heating units, announces the appointment of Richards-Conant, a sales engineering organization of Denver as representative in The Rocky Mountain states.

J. A. Richards came to Denver in 1905 and has been a manufacturer's representative for several mechanical lines for a number of years.

A. B. Conant was affiliated with Montgomery Brothers, Chromalox west coast representatives for the past 25 years.

The Richards-Conant organization, with years of industrial experience and the know-how of electric heat behind it, stands ready to give the area from Montana through New Mexico thorough engineering assistance and service on industrial applications.

The Rapid-Standard Company, Inc.—Lawrence E. Hillis recently was named to represent The Rapids-Standard Co., Inc. in the Cleveland area. He will direct sales activities for the entire line of Rapistan material handling equipment.

Mr. Hillis assisted in agency supervision at the Grand Rapids office until recently. Prior to this he held a sales position with The Rapids Handling Equipment Co. of Philadelphia.

The Rice Pump and Machine Co.—Formerly a division of Milwaukee Chaplet & Mfg. Co., this company has recently been established as a separate corporation. R. D. Houghton, formerly division manager, has been elected president and treasurer of the new corporation. Erwin Losse, formerly superintendent of the Rice Pump division, is secretary, while Robert G. Rice, president of Milwaukee Chaplet, is vice-president of the new corporation.

Mr. Houghton will serve as general manager and sales manager of the Rice Pump and Machine Co. and Mr. Losse will be in charge of manufacturing, engineering and product development.

The new corporation will continue the manufacture of Rice Centrifugal Pumps in a complete range of sizes and models for contractors, utilities, mines, oil fields, and industry, in addition to die filers and profile grinders for the tool making industry, and sprue cutters for non-ferrous foundries. The office and manufacturing operations will be continued at present address.

Metals Disintegrating Co., Inc.—H. E. Hall, president has announced the promotion of George H. Tulley to manager of the company's Cleveland office. Mr. Tulley will serve the company's customers in the metallic pigment field in the Cleveland territory at the same time retaining his position in the company as powder sales supervisor.

Mr. Hall explained that these plans are in line with the broadening of the company's activities in the pigment and metallic powder fields. With more than 15 years experience in those fields, Mr. Tulley brings to the Cleveland area a wide knowledge of industrial applications of such products in a varied list of industries.

Koppers Co,, Inc.—General Brehon Somervell, president since May, 1946, was named chairman of this company's board of directors. He was elected following the retirement of J. P. Williams, Jr., as company chairman. Mr. Williams was elected to the presidency of Koppers Co. and as executive vice president of Koppers United Co. in 1939. From 1944 to April, 1946, when General Somervell became president, he served as president and chairman of the board of the present company.

Last May, Mr. Williams announced his retirement from active management of the Company, but he had retained the chairmanship until today. He will remain a member of the board.

W. F. Munnikhuysen, who has been vice president and general manager of the company's Wood Preserving division, was made executive vice president of the company. He has, at various times, been connected with three of the company's six divisions and has a wide knowledge of its operations. In his new position, Mr. Munnikhuysen will be the second highest executive officer of the company.

New board members are Mr. Munnikhuysen and Joseph Becker, who is vice president and general manager of the company's engineering and construction division. Mr. Becker's connection with Koppers began in 1910. He became a leader in guiding the Company to a position of prominence as a builder of coke ovens, and plants related to them. He has been chief executive of the engineering and construction division since 1925.

Allied Control Co., Inc.—G. E. Harris, Administration Building, Municipal Airport, Wichita, Kansas, has been appointed to handle sales of electrical relays in Kansas and western half of Missouri.

The new Western assistant sales manager was born in Wyoming, Illinois, and attended Bradley University and the University of Wisconsin, where he majored in economics. Mr. Foster was chief of the Tracklaying Tractor Section, WPB in Washington, D. C., from 1942-1945, and previous to that he had served as secretary-treasurer of Avery Farm Machinery Co. He joined the general sales department of Caterpillar Tractor Co. in March 1945 as a consultant, became manager of sales service division in July the same year. In May, 1947, Mr. Foster was appointed district representative in the Eastern sales division, and in July, 1948, he was promoted to ass't Eastern sales manager.

The Baker-Raulang Co.—Baker Industrial Truck Division of The Baker-Raulang Company, Cleveland, Ohio, announces the election of Robert H. Davies as vice president and acting general manager, and Edward H. Remde as vice president.

Mr. Davies joined Baker-Raulang as manager of engineering with supervi-

sion of all engineering functions of the company. Before coming to Baker he was associated with the Lockheed Aircraft Corp., as production engineer; Northrup Aircraft Inc., where he was in charge of all production and tooling methods for experimental and prototype airplanes and helped develop the Heliarc welding process for magnesium; Henry J. Kaiser Company as plant engineer in the building of Kaiser's magnesium plant, the alloy plant, the ferro-silicon plant and the magnesium sand-casting foundry; and at Permanente, Calif. where he subsequently became superintendent and was in charge of production and plant development.

Just prior to coming to Baker Mr. Davies was with Lincoln Electric Company serving as their representative in Washington, D. C. and as consulting engineer in charge of educational work. He is a graduate mechanical engineer of the University of Minnesota and is an active member of the American Welding Society.

Edward H. Remde this year will complete 50 years of continuous service with The Baker-Raulang Company. Born in Medina, N. Y., he left home after finishing grammar school to work on a farm. Two years later he started at Bignall Foundry Company to learn the machinist's trade. On July 7, 1900 he started as a draftsman for Baker Motor Vehicle Company. In 1904 he was made chief draftsman of the company, assistant chief engineer in 1915, chief engineer in 1918 and works manager in 1938.

General Electric Co.—Albert P. Mansfield retired last month after 41 years of service with General Electric, it was announced by J. D. Wright, manager of the company's Industrial Engineering Divisions.

Employed in the Paper and Textile Division, Mr. Mansfield is considered to be an expert on all phases of yarn preparatory processes, cloth weaving, and finishing, and is well known in the textile industry. His main interests have always been along the lines of new developments, having instigated and participated in many activities in the General Engineering and Consulting Laboratory. His investigations have been along the lines of the very inclusive subject of tension control, and on specific problems such as sliver density control, variable speed spinning, and weft straightening.

Ahlberg Bearing Co.—Appointment of H. F. Hagenauer to purchasing agent was recently announced by Fred O. Burkholder, president of Ahlberg Bearing Company, Chicago. He succeeds P. F. McGuinn, for many years vice president and purchasing agent of the company, who died last November.

Mr. Hagenauer, with Ahlberg for 31 years, was first assigned to the stock record department immediately upon his discharge from the Army's 131st Infantry, 33rd Division in June 1919. From there he advanced to the sales department and in 1922 became assistant purchasing agent.

International Acetylene Association—Claude E. Monlux, vice-president, The Linde Air Products Company, New York, N. Y., has been elected

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president of the IAA. James W. Dunham, vice-president, National Cylinder Gas Company, Chicago, was elected vice-president of the Association. E. V. David, assistant manager of the Technical Sales division, Air Reduction Sales Company, New York, was re-elected treasurer. H. F. Reinhard was re-elected secretary.

Mr. Monlux joined the Purox Company early in 1919 as a salesman. In 1924 he became district manager for the Purox Company in Seattle, Washington, and was district manager in Oakland, California, from 1926 to 1929, when the Purox Company was purchased by Union Carbide and Carbon Corporation. In September, 1929, he was appointed district manager of The Linde Air Products Company in San Francisco. From 1930 to 1932 he was division manager in Los Angeles and from 1933 to 1935, Pacific division manager of The Linde Air Products Company. He was transferred to Toronto, Canada, as vice-president and general manager of Dominion Oxygen Company and the Canadian Railroad Service Company, Limited in April, 1935. In May, 1938, Mr. Monlux went to New York as Eastern division manager, The Linde Air Products Company. He has been a vice-president of Linde since April, 1944.

Illinois Institute of Technology—Dr William R. Osgood, 54, authority on the behavior of engineering materials, has joined Armour Research Foundation of Illinois Institute of Technology as a research engineer.

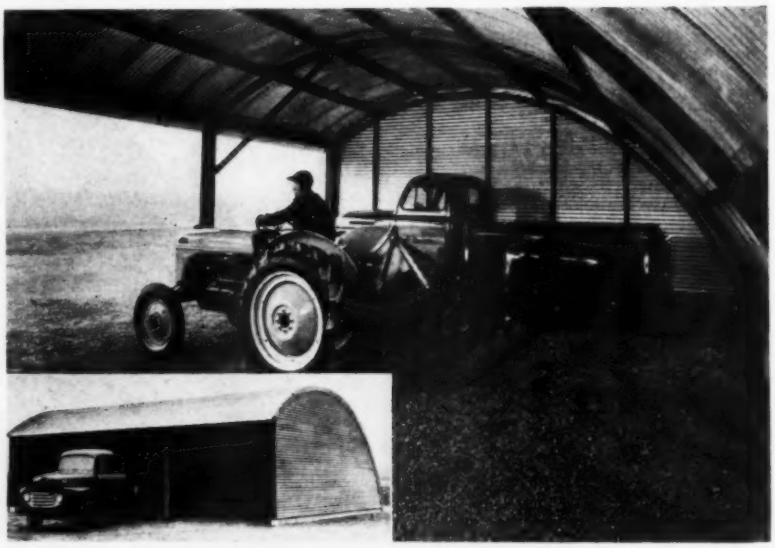
Since 1946, Dr. Osgood has been with the Navy Department, where he did technical liaison work between the Navy and its contractors. From 1929 to 1946 he was a materials engineer for the National Bureau of Standards in Washington, D. C. He served as assistant professor of structural engineering at Cornell university from 1926 to 1929 and was an instructor in theoretical and applied mechanics at the University of Illinois from 1921 to 1926.

Fairbanks, Morse & Co.—At a recent meeting the board of directors elected two new vice presidents: O. O. Lewis, vice president in charge of sales, and F. J. Heaslip, vice president in charge of purchases and traffic.

Mr. Lewis joined the organization in 1908 as a clerk. For a number of years he was a sales engineer in Indiana, Ohio and Michigan territories. In 1932 he was appointed manager of the company's Atlanta branch house, which position he filled until December 1943 when he was moved to Chicago headquarters and appointed assistant sales manager. In 1948 he was promoted to sales manager, and now vice president of sales and director of the company.

He is well known in various engineering societies as he is a member of the ASME, The Society of Naval Architects and Marine Engineers, and The American Society of Naval Engineers, Inc.

Mr. Heaslip joined the company in 1927 as a buyer in the purchasing department. He was made purchasing agent in 1935 and director of pur-



LOW-COST QUONSET DESIGNED FOR UTILITY

The illustrated low-cost utility building, called the Quonset 24 Special, is a new development in this type of steel arch-rib structure. It features a streamlined design using high-tensile alloy steel members by which new economies are achieved in small-building construction. These savings, according to the Great Lakes Steel Corp. Stran-Steel Division—the manufacturer—result from minimizing the material, parts and labor required without sacrifice in size of strength. Building is 24 ft wide, and comes in 12 ft lengths

chases in 1942. He has been a director of the company for several years, and his election to the office of vice president in charge of purchases and traffic is a well earned tribute to his ability.

He is very well known in purchasing circles, having served as secretary of the Chicago Association of Purchasing Agents for eleven years, at which time he edited the "Chicago Purchaser" magazine. He is a former member of the National Association of Purchasing Agents Business Survey Committee, and author of a monthly article written on the "Trend of Commodity Prices".

Hall Laboratories, Inc.—Although Dr. Ralph E. Hall will continue his scientific work as consultant with the firm, and remain a member of the board of directors, he has relinquished active direction of the Laboratories to Dr. Everett P. Partridge. Dr. Partridge has been director of Research for Hall Laboratories and another Hagan subsidiary, Calgon, Inc., for many years.

Dr. Hall is regarded throughout industry as the founder of scientific water-conditioning. In the early 1920's, when remedies for boiler scale and corrosion had given industry a "medicine show" touch of pseudo-scientific knowledge, Hall began a cooperative study with the Bureau of Mines to determine the true chemical and physical causes of these troubles. His discoveries provided the first scientifically solid theory on the formation of scale in steam generators.

Dr. R. E. Hall

His work led further to the rediscovery of "Graham's Salt"—which had spent its first century on the laboratory shelf—and successful application of this then-unknown phosphate material to the job of keeping boiler water in proper chemical balance.

American Standards Association—William L. Batt, Philadelphia, has just been elected director of the American Standards Association. Mr. Batt, who is president of SKF Industries, Inc., took a leading part in the standardization campaign that united the United States, Great Britain, and Canada on the dimensions of ordinary screw threads that hold together most of the world's machinery.

As chairman of the Sponsors Council on Unification of Screw Threads, Mr. Batt was influential in securing agreement on the international level. This accord ended 30 years of sporadic negotiations and more than 80 years with divergent screw threads.

Automatic Transportation Company—Appointment of Ressler A. Dusseau as manager of the engineering cost control department was announced by Elmer F. Twyman, general manager. The position has been created to coordinate efforts of the engineering,

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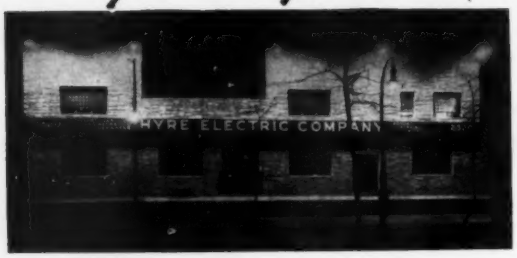

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methods, purchasing, and production departments. It will be Dusseau's responsibility to review engineering designs for possible savings in manufacture and design of products.

Mr. Dusseau came to Automatic in October, 1949, from the Navy department in Washington, D. C. He worked for the government from 1946 to 1949 as head of the automotive division, bureau of aeronautics. Earlier he was supervisor of technical education with the Briggs' Manufacturing company, Detroit, and with the Pontiac division of General Motors as an engineer.

He received a BS in mechanical engineering from Michigan College of Mines, Monroe, Mich., where he also completed graduate work.

The Rapid-Standard Company, Inc.—Harvey M. Rasmussen has been appointed assistant sales manager of The Rapids-Standard Company, Inc. manufacturers of material handling equipment.

In 1939, Mr. Rasmussen began selling for Rapids-Standard and left in 1944 to found the Rapids Handling Equipment Company of Grand Rapids, distributors for Rapistan material flow equipment. He continues as president of this organization, which has offices in six Michigan cities.

In 1948, he rejoined Rapids-Standard as central regional manager. In this capacity he coordinated sales activities for 15 agencies. As assistant sales manager, Mr. Rasmussen will supervise all major distributing agencies representing the materials handling manufacturing firm.

A native of Manistee, Michigan, Mr. Rasmussen received a degree in Business Administration from the University of Michigan in 1932.

Pittsburgh Coke & Chemical Co.—Appointment of Russell W. McIntosh as west coast representative has been announced by Russell H. Coe, manager, Protective Coatings div.

An active member of NACE, AWWA and the California Sewage Works Association, Mr. McIntosh handled sales for the Koppers Co., Inc., in northern California, Washington, Oregon and British Columbia, Canada, prior to his affiliation with Pittsburgh Coke & Chemical Co. His previous experience includes four years in the U. S. Navy and six years with North American Aviation Co. as an industrial engineer.

R. W. McIntosh

E. D. Haigler

Fischer & Porter Co.—Mr. Edmund D. Haigler has recently joined the Fischer & Porter Organization in Hatboro, Pennsylvania, to work on special customer engineering problems.

Mr. Haigler, a graduate of Harvard Engineering & Business Schools, has over twenty years' experience in industrial instrumentation; with the Chevrolet Division of General Motors, the E. I. du Pont de Nemours & Co., Inc. (Ammonia, Cellophane, Rayon) and the Foxboro Company. He was manager of Foxboro's engineering department for several years, and recently completed a 2-year survey of the mining, milling and smelting industries.

A member of the ASME, AIME and NSPE, Mr. Haigler was on the four-man instrument team which studied German industry for the U. S. Government in 1945.

Iron Fireman Corp.—Elevation of three long-time Iron Fireman men to newly created sales positions has been announced by C. T. Burg, president of Iron Fireman Corp. They are: Howard M. Cutshaw of Cleveland, from assistant sales manager to domestic division sales manager; Stewart H. Kibbe of Minneapolis, from division engineer to industrial division sales manager; and C. D. Carter of Cleveland, from central division sales manager to assistant sales manager in charge of organization development.

Mr. Burg said the promotions are part of Iron Fireman's "greatly expanded sales program for 1950". "Because of the steady increase in commercial and industrial sales, our new production program and sales of domestic units separate industrial and domestic sales divisions have been created. To supplement this, C. D. Carter will be in charge of new dealer selection and the field sales training program", the executive asserted, adding that, "These organizational changes not only reflect the general growth of Iron Fireman but are important in getting the expanded 1950 sales program into full swing".

C. D. Carter

H. M. Cutshaw

Mr. Cutshaw, newly named domestic division sales manager, joined Iron Fireman in 1928 as a district representative with headquarters at Portland and has been assistant sales manager since 1945 with offices in Cleveland. Shortly before he started with Iron Fireman, Mr. Cutshaw had come west from Tennessee, his home state. Three months later he was sent to the Kentucky, southern Indiana and Tennessee territory. In 1935 he moved to Cincinnati as district representative in Ohio and five years later was made Central division sales manager with headquarters at Cleveland.

Mr. Kibbe, the new industrial division sales manager, has been with Iron

Fireman since 1934 when he started in the product and engineering development department at Portland. He started with the heating concern soon after graduation from Oregon State college, and after three years became field engineer at Boston. He entered service in 1941 and emerged a lieutenant colonel. Returning to his peacetime job he was made district engineer in the Northwest division.

Mr. Carter, now assistant sales manager, organization development, started with Iron Fireman even before he finished studying at Oregon State college in 1927. By 1929 he was a field engineer in the Mississippi Valley territory and later he returned to Portland to assist in dealer education. In 1931 he went to Cleveland to start the first Iron Fireman's dealer mechanical training schools. Next he went into the southern states as a district representative becoming southern division sales manager in 1935. He became central division manager in 1945.

S. H. Kibbe

National Electric Products Corp.—Harold J. Newton resigned on March 1 as vice president and general sales manager of National Electric Products Corp., Pittsburgh. In making this announcement, W. C. Robinson, Jr., vice president, said the Newton resignation was for reasons of health. Mr. Robinson indicated that his office would supervise sales of the company's electrical roughing-in materials.

The resignation of Mr. Newton brings to a close a 38-year continuous sales effort for National Electric products. A native of Chicago, he went to work there in 1912 as a salesman for I. A. Bennett & Co., exclusive sales agents for National Electric materials. His territory included most of the midwestern states.

Mr. Newton came to Pittsburgh in 1929 as eastern district sales manager for National Electric Products Corp. In 1931 he was named western sales manager in charge of eleven western states with headquarters in San Francisco.

In 1943 Mr. Newton was appointed sales manager of the corporation and returned to the Pittsburgh general offices. Mr. Newton was later elected vice president and a director of the company.

Clarostat Mfg. Co., Inc.—The appointment of Henry D. Sarkis as sales representative is announced by Clarostat Mfg. Co., Inc., Dover, N. H. Well known in the radio-electronic trade, Mr. Sarkis will cover the industrial accounts in metropolitan Chicago and metropolitan Milwaukee areas, working out of his headquarters at 6459 Sheridan Road, Chicago.

A graduate electrical engineer of the University of Pennsylvania, Mr. Sarkis was with RCA at Camden from 1929 to 1941, serving in various executive

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capacities and more particularly in design, test and approval of components. During World War II he was with Crosley in Cincinnati, working on classified or secret projects from 1941 to 1944. After handling general instruments sales for the entire east, he became sales representative in 1947.

Link-Belt Company—Announcement has been made that Mr. H. Walter Regensburger was appointed chief engineer of the general engineering department to succeed Mr. Harry L. Strube, who has retired. Assisting Mr. Regensburger, will be Charles M. Young, Jr., in the capacity of chief developmental engineer, and Harold F. Watson as Chief standards engineer. Both men have been identified with the general engineering department since it was first organized in Philadelphia in 1946 and both were previously members of the Philadelphia plant engineering department.

Mr. Regensburger, a mechanical engineering graduate of Armour Institute of Technology (I.I.T.) entered the company in 1926. He has served in the estimating-engineering departments merchandise sales; chief engineer at the company's Atlanta plant, 1936 to 1944; assistant to the vice-president in charge of engineering, 1944 to 1947; and as divisional and assistant chief engineer.

Lincoln Electric Company—C. L. Stocker has assumed sales and engineering responsibilities for Lincoln in the San Francisco area. The office for this district is located at 1303 Stanford Avenue, Emeryville, California. Stocker has been active in various parts of the country in the development of welding for the past twenty years. He started with Lincoln in 1930 and has been district manager of the Seattle area since 1943. The welding engineering staff of the Emeryville office has recently been increased by the addition of M. F. Yale and T. Nichol, both recent engineering graduates with several years service in the armed forces.

A. L. Patnik has been given responsibility for Lincoln welding engineering in the Seattle district, with offices located at 1914 Utah Avenue, Seattle, Washington. Patnik has been with Lincoln since his graduation from Ohio State University in 1940 and, except for his term in service, has been active in the development of welding on the West Coast.

Thomas C. Wilson, Inc.—The safety release pressure bolt business of Dunton-Chambers Manufacturers, New York City, has been purchased by Thomas C. Wilson, Inc., 21-11 44th Avenue, Long Island City 1, New York. The announcement was made by O. J. Bagnoli, vice president of Thomas C. Wilson, Inc.

Through the sale, Wilson, long established manufacturer of tube cleaning and tube expanding equipment, acquires Dunton-Chambers' complete line of business including inventory, engineering data, good will and sole manufacturing rights.

According to O. J. Bagnoli, vice president of Thomas C. Wilson, Inc., the company will combine the manufacture of the new safety release pressure bolt with their long established line of tube expanders and tube cleaners. This new line will be given wide distribution by the Wilson organization and marketed under the trade name of Wilson-Dunton.

Hercules Powder Co.—Leavitt N. Bent, vice president of Hercules Powder Company, was appointed vice chairman of the board of directors. The new vice chairman is distinguished by his 43 years of service in the manufacture of explosives and chemicals, one of the longest records of service of any person now active in the industry. The vice chairman will preside over the meetings of the board in the absence of Charles A. Higgins, president and chairman of the board.

Socony-Vacuum Oil Co.—Fred A. Walters, assistant general manager in charge of manufacturing of the Socony Paint Products Company, Metuchen, N. J., has been promoted to vice president of the organization, according to an announcement by S. G. Lansing, president and general manager. He succeeds C. G. Nelson, retired Jan. 1.

Mr. Walters started in 1912 with the Standard Oil Company of New York as a stenographer and statistician in the export department. He was transferred in 1921 to China, remaining there for nine years in charge of the manufacturing and installation department. He returned to this country as a buyer in the purchasing department of the Socony-Vacuum Oil Company, Inc., and was transferred to the paint division as Mr. Nelson's assistant on Jan. 1, 1942. He became assistant general manager in charge of manufacturing in 1945.

The Midway Tool Co. — Appointment of Don Smith as production manager of the polishing and finishing division of the Midway Tool Co., Inc., Melvin, Ohio, has been announced by H. B. Horner, president.

Don Smith

Mr. Smith will also act as expediter to maintain a continuous flow of production in manufacture of Midway's new "Mirbrite" (mirror bright) auger bits for hand braces and electric drills. He has been a member of the Midway organization for the past two years. Prior to joining Midway, he had more than 20 years experience in the auger bit industry.

Caterpillar Tractor Co. — Appointment of Frank S. Foster, assistant sales manager, Eastern division of Caterpillar Tractor Co., Peoria, Ill., to assistant sales manager, Western division, is announced by H. H. Howard, director of sales.

Mr. Foster is replacing Truman E. Sage who is resigning from Caterpillar

Tractor Co. to join the Caterpillar distributor for Alaska, Northern Commercial Company, Seattle.

Gordon J. Fowler, district representative in the San Joaquin Valley, California, is promoted to assistant sales manager, Eastern division.

The Babcock & Wilcox Tube Company—The appointment of H. F. (Skip) Lefferty as Pacific Coast sales manager has been announced by Edward A. Livingstone, vice president of the company. Mr. Lefferty succeeds H. P. Curtis who has resigned to enter other activities.

Mr. Lefferty has been with Babcock & Wilcox for 33 years. From 1917 to 1928 he was associated first at Beaver Falls, Pa., and later at the Bayonne, N. J. and Barberton, Ohio plants. His activities were transferred to the sales department of the Tube Company in 1928. Since that time he has been manager of the Cleveland sales office, district sales manager at the Beaver Falls office, and recently, district sales manager at the Chicago office. Mr. Lefferty's new headquarters will be in the Petroleum Building, 714 Olympic Boulevard, Los Angeles, Calif.

The Parker Appliance Co. — New appointments in the Rubber Division of The Parker Appliance Co., Cleveland, announced by S. B. Taylor, president, reflect expanded company operations in the formulation of special compounds and the precision molding of O-rings, diaphragms, special gaskets and other seals.

Edward W. Hollis, for the past two years vice president of Laminated Plastics, Inc., Cleveland, becomes manager of the division, with particular attention to production matters. Hollis, a native of Waco, Texas, was from 1946-8 sales manager of Coach & Car Equipment Corp., Chicago, following 17 years of naval service. His most recent duty was Captain in Charge of the Training Office, War Shipping Administration, in Washington.

D. W. Holmes, general sales manager, has assigned to E. L. Carlotta, the divisions research and development engineer, the additional responsibilities of managing rubber sales.

Don C. Pierce, Jr. has joined the company as a rubber sales engineer. An air force officer during the war years, he joined the Curtis Sales Corp. as sales manager in 1947, and holding the same position with the Cleveland Republic Tool Corp. for the past year.

Borg-Warner Corp.—R. C. Ingersoll, president of the Ingersoll Steel division, Borg-Warner Corp., announces the appointment of C. M. Baker as chief engineer of the Kalamazoo, Mich. Works. Mr. Baker succeeds L. C. Freeman, who has recently reached the retirement age.

Mr. Baker was assistant chief engineer responsible for directing research and product development of Ingersoll's complete line of gas, oil and coal furnaces and winter air conditioners. He joined the company in 1944.

Prior to his affiliation with Ingersoll, Mr. Baker was in charge of engineering with the Cerro de Pasco Copper Corp. at Cerro de Pasco, Peru, S. A. Later he was a design engineer for Re-

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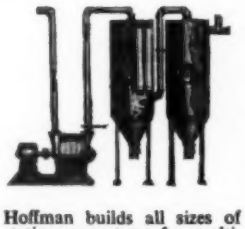

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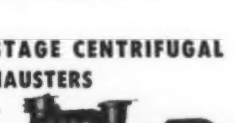

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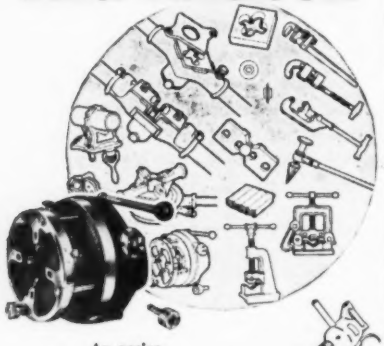

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General Controls—J. F. Ray, vice president in charge of sales, General Controls, Glendale, California, manufacturers of automatic pressure, temperature level and flow controls, announced today the opening of the company's 22nd branch office at 721 South Orange Avenue, Newark 6, New Jersey. The new office will include extensive warehouse facilities where a complete line of General Controls will be stocked to more efficiently serve customers on the Eastern Seaboard. William Buck, formerly sales engineer for the Company's Philadelphia Branch, has been named as Newark branch manager. Other organizational changes include the appointment of R. M. Korty as branch manager in St. Louis, Mo.; the addition of Robert L. Day to the sales engineering staff in San Francisco and the appointment of Rudolph J. Roedder, sales engineer, as refrigeration specialist in the Los Angeles Sales office.

Hungerford & Terry, Inc.— This manufacturer of water treating plants has announced the appointment of Mr. Lyle B. Porter of Rockford, Ill. as their representative in the Northern Illinois-Eastern Iowa district. Mr. Porter has had many years of experience in water conditioning work and comes to Hungerford & Terry well qualified to handle their work.

The Kennedy Valve Mfg. Co.—Purchase of the Semler Company, Jeannette, Pennsylvania, manufacturer of cast-iron pipe fittings was announced today by Charles F. Kennedy, president of The Kennedy Valve Mfg. Co., Elmira, New York. Manufacturing operations would be continued at the Jeannette plant.

The Semler Company, with about 220 employes, has been engaged in the manufacture of cast-iron fittings since 1915. New officers of the Company are Charles F. Kennedy, president, J. Lawrence Kennedy and Howard P. Semler, vice presidents, Thomas S. Turkington, controller.

The Kennedy Valve Mfg. Co., now in its 73rd year, operates two plants at Elmira, N. Y. Addition of the cast-iron fittings to the present line of malleable iron and bronze fittings is expected to make the Kennedy line one of the most complete in the fittings industry.

The National Radiator Co.—Roland A. Hazell has been named manager of the new Buffalo, N. Y. branch sales office which has been established by The National Radiator Co., Johnstown, Pa.

Mr. Hazell joined National Radiator in 1925 as a storekeeper in the Johnstown plant. He later assumed various responsibilities in the company's accounting, industrial and sales departments at the general office. In 1947, he was named a territorial salesman and was assigned to the Philadelphia branch sales office. For the last two years, Mr. Hazell from headquarters in Cortland, N. Y. has covered Central New York State.

The new Buffalo branch office will be responsible for sales of the company's heating equipment in the western counties of New York State and in the northwestern counties of Pennsylvania.

M. W. Kellogg Co.—Warren L. Smith, former senior vice president, has been elected president succeeding Harold R. Austin, who is retiring.

The executive staff has been enlarged with Bennett Archambault, former treasurer, being elected vice president and general manager. G. Frank Bayes, Ronald B. Smith and Zary A. Toula were named vice presidents. Incumbent vice presidents Dr. William E. Hanford, Alexander Kidd, and Frank Liebrecht were re-elected. Daniel J. Olsen was elected treasurer and comptroller and Edwin L. Gidley, secretary.

In retiring Mr. Austin leaves an association formed 47 years ago when he joined the M. W. Kellogg Co. as an engineer-salesman. With the firm during its growth, Mr. Austin by virtue of his great contributions assumed the Kellogg presidency in 1944, he will continue to serve the needs of the company as a consultant to the president.

W. L. Smith

B. Archambault

Mr. W. L. Smith is a well-known chemical engineer who has been with the company since 1937. Elected a vice president of the Canadian Kellogg Co., Ltd., in 1939; he subsequently became vice president of the parent company in 1943. Three years later, he assumed complete charge of the company's commercial activities.

Mr. Archambault, vice president and general manager is a prominent engineer who joined M. W. Kellogg in 1946, after outstanding wartime service as head of the London office of the Government's office of scientific research and development.

F. Bayes

R. B. Smith

Mr. Bayes, a familiar figure in petroleum and chemical circles, has been actively engaged in the construction phase of Kellogg activities for 30 years. He was named director of construction in 1944.

Mr. Ronald Smith, who joined M. W. Kellogg in 1948 as director of en-

gineering, is well known in engineering and scientific circles and is a consultant to the Atomic Energy Commission and a member of the National Advisory Committee for Aeronautics.

The Imperial Brass Mfg. Co.—Fred'k C. Shafer, for the past 12 years vice president of The Imperial Brass Manufacturing Co., Chicago, and associated with the company for the past 24 years, has been elected president and chairman of the board of directors of the company. C. H. Benson, sales manager, automotive-industrial-refrigeration distributor sales, has been named vice president. J. X. Allman continues as manager of industrial distributor sales.

Rockbestos Products Corp.—This firm announces the opening of another district office in New Orleans to be responsible for the states of Louisiana, Texas, Mississippi, Alabama, Georgia and Florida.

Warren S. Jones has been appointed district manager of the new office. He joined Rockbestos in 1941, serving in the production, engineering and sales departments, and since 1947 has been in charge of the Glendale, Calif. office.

Howard G. Jones, an electrical engineering graduate of the University of Vermont in 1948, will replace Mr. Jones in the Glendale office.

The Electric Products Co.—Sheldon Storer and Associates has been appointed as district representatives for the southwestern section of Ohio and the State of Kentucky. Sheldon Storer and Associates, with offices in Cincinnati, Ohio, will be responsible for promoting The Electric Products Company line of synchronous and induction motors, a-c and d-c motors and generators, battery chargers, electrolytic power supplies and frequency changers.

H. K. Ferguson Co.—This firm of industrial engineers and builders recently announced the acquisition of the O. D. Conover Engineering Co., of Cleveland, foundry design and construction specialists who have operated extensively throughout the United States.

The staff of the Conover organization will form the nucleus of a newly-established Foundry Division within the H. K. Ferguson Co., according to Otto F. Sieder, executive vice-president and general manager. The Foundry Division will be headed by Oliver D. Conover, nationally recognized foundry engineer who has directed the operations of his firm since its founding in 1932.

The Reliance Electric & Engineering Co.—Addition of Jack H. Eichler to the staff of the Boston office has been announced by E. E. Helm, sales vice president. In his new work as a field sales engineer, he will report to Leon M. Dunning, Boston district manager.

Mr. Eichler has been employed by Reliance as an application engineer since 1946, devoting much of his time to electric power drive installations for the paper and allied industries.

Born in Cleveland, he attended Cleveland Heights High School, was graduated from Case Institute of Tech-

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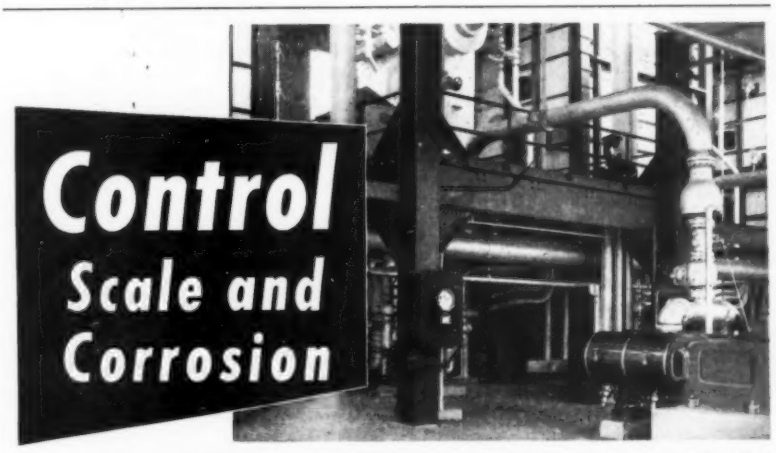
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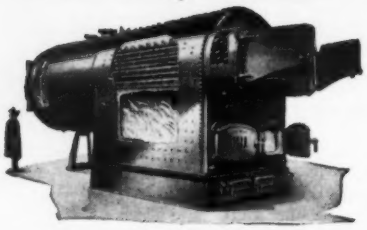

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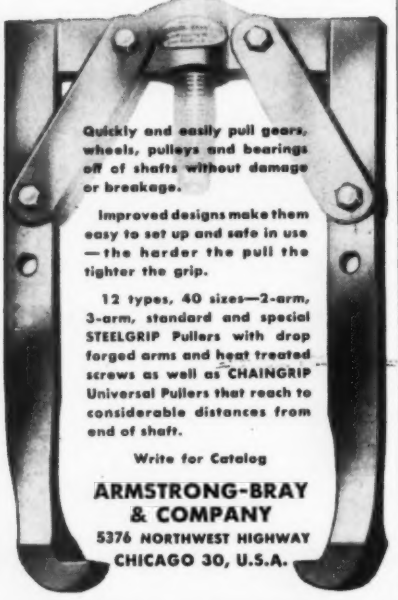

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nology in 1941, and served nearly five years in the U. S. Air Force. He attained the rank of major and has 3200 hours as a pilot in the Troop Carrier Command to his credit. In 1946 Mr. Eichler completed work at Columbia University on his master's degree in industrial engineering. He is a member of Tau Beta Pi, honorary engineering fraternity, and Phi Delta Theta, social fraternity.

Fairbanks, Morse & Co.—Two changes in branch house management organization were recently announced by Fairbanks, Morse & Co., Chicago manufacturers.

J. C. Elmburg, who has for the past three years been Manager of the Atlanta Branch, has been transferred to Portland, Oregon, where he has assumed the duties of branch manager, succeeding Howard Oxsen. Mr. Oxsen is returning to San Francisco to be manager of diesel engine sales in that area.

George A. Hawkins has been appointed manager of the Atlanta Branch. Mr. Hawkins has, for the past several years, been manager of the company's sub-branch at Minneapolis.

R. P. Adams Co.—Machinery & Equipment Sales, Inc., Baltimore, Maryland, has been appointed exclusive representative in the State of Maryland.

The R. P. Adams products which will be handled by this company include Poro-Stone filters for removing moisture, oil, pipe scale and other solids from compressed air and other gases; Poro-Stone liquid filters for removing solids in suspension in water and various chemicals; and Adams pipe line aftercoolers and cyclone separators for removing moisture and oil in vapor form from compressed air and other gases.

L. N. Crissman Co.—The addition of Thomas J. Dempsey, Jr., to its sales force was announced by the L. N. Crissman Co., materials handling equipment sales firm at Pittsburgh, Pa. Crissman is representative for the Automatic Transportation Co., Chicago, manufacturer of Automatic Skylift and Transporter electric industrial trucks.

Before joining Crissman, Mr. Dempsey was with the National Bearing Division of the American Brake Shoe Co. as manager of the Pittsburgh sales office.

H. K. Porter Co., Inc.—Quaker Rubber Corp., Philadelphia, now a division of the H. K. Porter Co., Inc. of Pittsburgh, has opened a new stock carrying branch at 311 First Avenue, Pittsburgh, Pa.

The new branch is under the direction of Mr. H. M. Sossaman, who was assistant general sales manager for Quaker before his appointment to this new position. Mr. Sossaman is in his twenty-third year with Quaker. He began as a salesman in the Florida territory, was instrumental in the establishment of several Quaker branches, and in 1943 was appointed Assistant General Sales Manager.

Quaker Rubber Corp. manufacture industrial rubber belting, hose, packing and special moulded rubber products.

Combustion Engineering—Superheater, Inc.—At a special meeting of the board of directors of Combustion Engineering—Superheater, Inc., Samuel G. Allen, formerly vice-chairman, was elected chairman of the board to succeed the late Frederic A. Schaff. Mr. Allen is identified, as an officer or director, with several other companies, including the Franklin Railway Supply Company, Lima-Hamilton Corporation, G. M. Basford Company, and the Lummus Company.

S. G. Allen

J. V. Santry

Joseph V. Santry, long president of Combustion Engineering Company and its successor, Combustion Engineering-Superheater, Inc., will also serve as chief executive officer in general charge of operations.

General Motors Corp.—Roger M. Kyes is now the general manager of the GMC Truck & Coach division of General Motors. Mr. Kyes succeeds Morgan D. Douglas, who is taking a leave of absence because of his health.

Mr. Douglas has been with General Motors for 35 years. He served with the Chevrolet organization for 30 years, including 16 years as general parts and accessories manager, before his appointment as general manager of the GMC Truck & Coach Division five years ago.

Mr. Kyes joined General Motors in August, 1948, and served as director of its central office procurement and schedules staff until his appointment to the GMC division in October, 1949.

The Babcock & Wilcox Co.—Cecil H. Gay, works manager of the Barberton plant of The Babcock & Wilcox Co., has been elevated to vice president according to Alfred Iddles, president.

Mr. Gay, who joined the company after graduation from the University of Nevada in 1928, has been connected with the Barberton operations since 1932. As a special assignment engineer he had an important part in designing and building the world's largest penstocks for Hoover (Boulder) Dam, and for Gauley ridge in West Virginia.

C. H. Gay

Electrolytic Methods That Prevent Corrosion

Engineers Convened Last Month In St. Louis To Exchange Information On Causes And Cures Of Many Corrosive Conditions

● **Abstracts** of technical papers presented at the Sixth Annual Conference National Association of Corrosion Engineers; April 4-7, 1950:

"A Study of Some Metals for permanent Anodes in Water Tank Cathodic Protection Systems", by A. L. Kimmel, University of Florida, Gainesville, Fla. —In the design of cathodic protection systems for water tanks using an external source of direct current it is necessary to select a metal from which the permanent anodes are to be fabricated. With the large number of metals and alloys now commercially available, the negineer has a wide selection and it is advisable that he have available data pertaining to the destruction rate of these metals at the approximate conditions of operation. According to Faraday's law, during electrolysis, a metal is destroyed in proportion to its equivalent weight, and the product of the time of current flow. This relationship is true if the metal is pure, being electrolized in a solution of its ions, and other effects are eliminated.

In water tank cathodic protection systems, these conditions are never present. The metals commercially available are not highly purified and polarization is pronounced. Mechanical working and surface treatment also produce an effect on the destruction rate which is not considered in Faraday's law. In the case of the alloys, metal destruction will depend, to a great extent, on the type (solid solution, eutectic, etc.) This paper presents corrosion data on a number of commercial metals and alloys used as permanent anodes. Investigations were made in water of pH 6.2 and 8.6; the latter having a higher alkaline earth content. The data are presented in both table and graphic form.

"The Performance of Magnesium Galvanic Anodes in Underground Service", by Oliver Osborn and H. A. Robinson, Dow Chemical Co., Midland, Mich.—The performance of magnesium galvanic anodes in underground service is reviewed in the light of the past five years of field testing in which upwards of 2500 anodes have been tested in some 40 different backfills and in various soils. The pertinent indices of galvanic anode performance are cited and the various factors influencing the performance of magnesium anodes are enumerated. A summary of the most outstanding findings relative to anode current efficiency, anode current output, and stability of current flow is presented. The effects of such factors as anode composition and impurities, current density, time, backfill composition, installation practice, soil characteristics, and weather on anode performance are discussed.

The high purity Mg-6A1-3Zn alloy continues to provide the most consistently efficient performance. At current flows equivalent to ten year life, efficiencies corresponding to 500 amp hr per lb are usually realized except in high chloride soils where higher current densities are needed to get comparable efficiencies. Impurities, notably nickel, iron, and copper must be held at low concentration levels in order to realize good anode efficiency. Pure commercial (cell) magnesium anodes occasionally exhibit high efficiencies but statistical experience shows their performance to be decidedly inferior to that of the high purity alloy. Field tests show the efficiency of the alloy anodes to increase with current density as previously indicated by laboratory data. Likewise, efficiency tends to increase with time.

With the exception of the magnesium sulfite and chromic acid backfills, the composition of the backfills used appears to have no very significant effect on anode efficiency. Anode current output is essentially a function of soil resistivity and cathod potential although it is influenced to some extent by backfill composition and backfill installation practice. Statistical data indicates that bockfills installed dry provide a higher level of current output than is obtained with wet (mud) backfills. Likewise, high conductivity backfills appear to provide significantly higher current flows. Excellent maintenance of current flow has been observed for periods of three to five years on relatively large numbers of anodes. The most stable current flows are associatel with deep installations and poor to fair soil drainage. Well draoined installations on slopes or elevations tend to exhibit poor current maintenance. Depletion of soluble backfill ingredients (gypsum, sodium sulfate) is evident after three to four years of service but current flow is not adversely affected so long as the moisture supply is adequate. Bentonite rich backfills are highly moisture sensitive and tend to expand or shrink excessively with fluctuating moisture levels. If installed wet they sometimes shrink enough to adversely affect anode to earth resistance. Stability of current flow is also affected by rainfall and temperature.

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Demineralization

(Continued from page 107)

10 times as many solids in the boiler as found in the makeup. The boiler water would then contain 20 ppm total solids, of which 2 ppm is silica and 2 ppm turbidity.

Since common practice for 1400-psi boilers demands internal treatment with such chemicals as phosphate, caustic soda and sodium chloride, column 5 of Table 1 gives concentrated boiler water as might be expected if the makeup were 2%, boiler blowoff 0.2% and chemicals were fed to the boiler water to prevent scale. Column 5 is further based upon dependence in the deaerator to prevent corrosion without sodium sulphite treatment. Analyses of Table I shows that when using demineralized makeup, the solids in the boiler water compare favorably with the use of evaporated makeup.

Owing to the relatively high bicarbonates in Lake Michigan water, it appears that a mixture of hydrogen and sodium Zeo-Karb treatment should be used. Using sodium zeolite alone would give quite a high alkalinity in the evaporator causing it to prime and give off too much free CO_2 in the vapor.

In evaluating the economies of either process, consideration must always be given to intangibles that cannot be accurately evaluated in dollars and cents. The designing and operating engineer, therefore, must exercise judgment based upon experience.

One of the greatest intangible advantages of demineralization is that the equipment may be operated at full rated capacity continuously regardless of the rate at which the turbine operates. An evaporator may produce 1 or 2% of makeup at all turbine ratings, but experience shows that at lower loads the percent makeup increases. That is particularly true if there are some standby boilers. Many of the steam and water losses are constant so total makeup requirements are a greater percentage at low rates of operation.

The Author expresses appreciation to E. B. Powell of Stone & Webster Engineering Corp. for information as to the early use of evaporators and to R. H. Marks of the Permutit Company for detailed calculations of the required heat balances.

*Abstract of a paper delivered at the Midwest Power Conference, Chicago, April 5, 1950

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Power Plant Cycles

(Continued from page 84)

will leave at the latter point. Flow rate through the 20 psia extraction opening is 15,500 lb per hr under these conditions, the remaining steam required for heating being obtained by pressure - temperature reduction from the main steam line. During the summer, required steam flow is 26,600 lb per hr for all purposes.

Annual fuel consumption of the cycle in Fig. 4 is 6,975 ton at a cost of $33,100. Annual operating cost is approximately $116,530, as listed under Scheme *C* in the Table.

On an annual cost basis, Scheme *D* appears to be most desirable. However, annual cost is not the only criterion. Quality and quantity of water available, relative cost of fuel in the plant locality, location of the utility station with respect to the industrial plant, expected life of the enterprise, local laws and regulations governing industrial plants, and labor conditions will affect the final decision. Higher annual costs, as in the case of the diesel plant, might be accepted in order to reduce coal storage facilities, piping layout, or building size. In other words, with a given project, any number of reasons may alter a decision which is based only on annual costs. However, annual costs do, generally, serve as the best means for making overall comparisons.

Feedwater heaters and turbine mechanical efficiency were neglected in this study because consideration would have introduced calculations requiring more space than available.

Where cycle and cost calculations show that all proposed arrangements are unsuitable, some variation of the cycles shown in this article should be tried. Such a wide variety of steam generators, prime movers, and control equipment are now available that it is usually possible to find some combination which will suit the needs of the particular plant.

Lastly, it should be noted that the results of these calculations are applicable only to the specific conditions assumed at the start of the problem. It is not possible to take the results of this comparison and apply them indiscriminately to any industrial plant. In

this case a 15 year life for equipment was assumed. Past experience in other industries might lead to use of a 20 or 25 year life for equipment. A succeeding article will discuss cycle applications in various industries.

Merit Awards

(Continued from page 114)

tation may appear in plant or company publications".

"Tangible evidences of recognition are valued highly by recipients. It is impossible, of course, to measure accurately the direct value of these awards to the Company, but the evaluation placed on them by recipients indicates their worthwhile place in our personnel program".

"In addition, there are other kinds of recognition received by employees —individual evaluation of each employee's performance. A record of this evaluation is filed in individual folders for use in selecting employees for promotion and thereby facilitating: (1) The elimination of departmental barriers in promotion. (2) Thorough training in preparation for the initial position or for possible promotion. (3) Assistance in case of death, disability or old age through carefully designed employee benefit plans. (4) Assistance in times of slack work which may occur in spite of careful forecasting of sales and scheduling of production.

"In a social and political environment which stresses the importance of the individual, singularly or in groups, we believe there is a direct relationship between recognition and performance. Recognition given by any enterprise to its employees not only contributed to the over-all effectiveness of the organization, but also is consistent with the American philosophy of dignity of the individual".

Active promotion of such awards is extremely important. It has been found that, in many instances, little provision is made to publicize the event either in the organization itself or in the community. When an important local employer rewards those working for him, the fact is *news* in the community in which his organization functions. Every fellow employee, in direct contact or not, is interested and all employees have friends and relatives directly interested.

Very often such events are publicized on regional radio broadcasts and in the local newspapers. Even pictures of honored employees of an established business or service are used in the newspapers, and such events certainly are "copy" for the organiza-

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Production is a combination of machine and man hours. Both are lost when machines slow down or are forced out of operation.

Dripping, leaking oil cuts production. It won't stay in bearings, so does not lubricate dependably, and needs frequent application. Bearings run hot, waste power and often burn out. Machines and man hours are lost till service is restored.

Production goes on where NON-FLUID OIL is used. Lubricant and application costs go down. NON-FLUID OIL does not drip or leak, keeps bearings cool, outlasts oil many times over.

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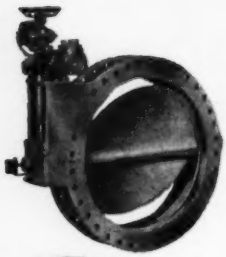
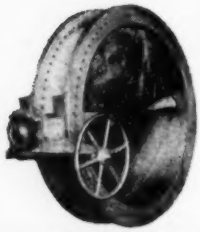


Butterfly valve, 42" pipe size, 125 lbs. flanged drilling, complete with motor and remote control having a torque of 300 ft. lbs. Streamlined blade moves on needle bearings; may be operated by auxiliary hand wheel.

Wafer type butterfly valve for close pipe coupling, 36" pipe size, with air diaphragm operator and pilot valve.



Butterfly valve 66" pipe size, hand wheel operated for a 7½ lb. air line in the power and blower division of an activated sludge plant. Yes, this is big, but we build them even as small as 1" size —cast or fabricated—for handling anything from fly ash to corrosive vapors containing abrasive particles, river water or high temperature gases or liquids, paper pulp, etc.

Rockwell slide (gate) type and butterfly valves for air, gas, liquids and semi-solids are available in pipe sizes to 84" — in all metals — with any manual or mechanical controls.

ROCKWELL BUTTERFLY VALVES

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tion's house organ and bulletin board.

There are, of course, numerous variations in such programs:

For instance, some employers, who have used the award system effectually over the years, give attention to *group* awards. A banner or plaque may be awarded according to their *group* achievement—possibly together with individual emblems in the form of buttons and/or pins. The banner may be permanent, or it may be won by a competing department or group in the next period. All this, it is said, tends to establish a friendly rivalry among sections, zones, departments or groups.

With respect to the type of *emblem* best suited to various purposes, great improvements have been made in design and manufacture. There are pins and buttons of the less expensive type for small organizations and for more routine achievements, and more elaborate insignias, even some encrusted with gems, for such distinguished workers as the "sixty-year employee".

It is one thing, of course, for the employer to maintain an annual program of merit awards and another to use a good system of promotion when (1) it comes to a contest of *performance* on the job, (2) the safety program needs stimulation, (3) attendance figures show lag, (4) the rate of performance needs a boost, or (5) seasonal changes occur.

On the whole, however, recognition and incentive awards, especially in the form and including the emblem, have become an established procedure with many tens of thousands of employers in all lines of business, with anywhere from 150 to hundreds of thousands of employees each. Properly programmed and exploited, they help instill greater loyalty to the employer and better yet, a greater loyalty of the individual to his or her job.

Rock Hill Plant

(Continued from page 90)

feedwater makeup. The latter amounts to approximately 50%.

To handle this flow of water, previously used condensate return piping, as well as piping for the boiler feeder header, were replaced with larger pipe. Prior to the installation of the new unit, all of the boiler feedwater had been pumped through an economizer heated with gas from the three stoker boilers. This arrangement, which works very well and results a stack temperature leaving economizer of approximately 350° F, has not been changed. The reason is that if all feedwater for both of the two large boilers and the three stoker boilers were fed through this economizer—which is not contemplated in the near future—stack temperatures would not be reduced to the point where corrosion would take place in the economizer and induced draft fan.

The feedwater header to both large boilers was looped and valved in such a manner that one or both can be fed either through the economizer or directly from the boiler feed pump bypassing the economizer, whichever procedure gives the best conditions. Should it be desireable, one unit can be fed directly from the boiler feed pumps and the other through the economizer.

The original pulverized unit was furnished with a small oil-burning system for "lighting off." It was recognized that with the two pulverized units in operation, there might be occasions when it would be necessary to take a pulverizer out of service during plant operation; in such a case, this small oil-burning system would be inadequate. Therefore, a large standby storage tank for light fuel oil was installed, together with pumps and burners having sufficient capacity to handle full load on one of these boilers for a limited length of time. This will make it possible to burn either coal or oil, or a mixture, depending on conditions in the fuel markets, although it is not normally economical to burn fuel oil in this area.

When installing the new boiler, it was necessary to add 54 ft to the length of the building and coal bunker. This addition encroached on an existing water storage well 90 ft in dia and 12 ft deep. Although this water storage could be spared, it constituted the suction pit for all of the service pumps supplying all plant operations. To get space for the building it was necessary to remove approximately two-thirds of this clearwell.

This was done by cutting through the walls and floor, exposing the reinforcing steel. Steel was cut and bent in such a manner that re-inforcing for a cutoff wall could be tied to it, after which the cutoff wall was built by Gunniting. This job presented an interesting feature of the installation, and has proved entirely satisfactory for approximately two years. All the bonds to the existing concrete seem to be good, and no cracks have developed. Time required for this complete job was five working days, during a period when the plant was shut down for routine annual maintenance and vacations.

Top Management:

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IN THIS CAMPAIGN TO BUILD *EVERYONE'S* INDEPENDENCE

The period May 15-July 4 marks an important campaign to strengthen the financial independence of the nation's people—and there's nothing of more basic importance to your own and your company's future than the country's economic well-being! What's more, you and other leaders of industry are the men who will be the principal deciders of the success of this campaign.

For this is the Treasury Department's *Independence Drive* to increase purchases of United States Savings Bonds. And the Payroll Savings Plan, now operated by 21,000 companies, is responsible for the greatest share of Series E Bond sales.

If your company doesn't have the Payroll Savings Plan, now's the time to install it! (A nation-wide survey shows that people are more than twice as inclined to invest their extra money in Savings Bonds as in any other form of investment. So it's good "employee relations" to provide this convenience.)

If your company does have the Plan, now's the time to put extra push behind it! Employees who pile up money in Savings Bonds feel more secure . . . are actually better workers. Moreover, Bond sales build a backlog of future purchasing power—good "business insurance" for all of us in the years ahead.

The Independence Drive will be powerfully promoted throughout the nation by radio, television, publication advertising, posters, car cards, and special ceremonies. The public will be *extra* Bond-conscious during this period. Make sure your company adequately informs your employees that the convenience of "automatic" Bond buying is available through your Payroll Savings Plan.

This is your country—and it's *your Drive.* Help to put it over! All the material and assistance you need are available from your State Director, Savings Bonds Division, U.S. Treasury Department. Remember—employees *appreciate* Payroll Savings.

The Treasury Department acknowledges with appreciation the publication of this message by

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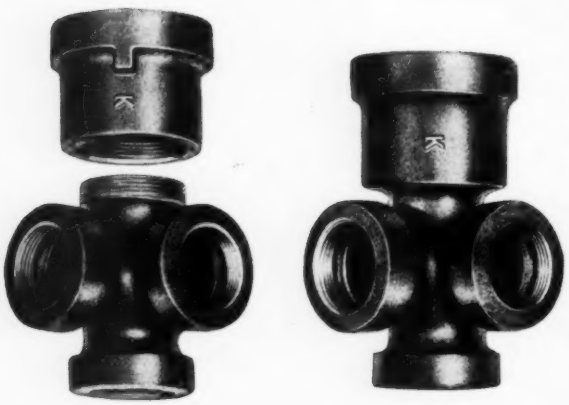
Originality in fittings



YOU may not need this new Util-TY in your plant, but it would save you considerable money if you were having a garbage disposer or dishwasher installed in your house kitchen. The Util-TY permits an added fixture to be tied into the sink drain without erecting a new vent stack.

We cite the Util-TY as an example of originality in pipe fittings. Since our business consists exclusively of designing and manufacturing fittings, we are always on the alert for new ideas; also to adopt improved methods for making the "K" line continuously better.

"K" Fittings fall into the following general categories:

- Standard and Extra Heavy Screwed Steam Fittings.
- Standard and Extra Heavy Flanged Fittings.
- Standard and Extra Heavy Companion Flanges.
- Standard Sprinkler Fittings.
- Standard Drainage Fittings, Black and Galvanized.
- Standard Bushings, Plugs, Flange Unions.

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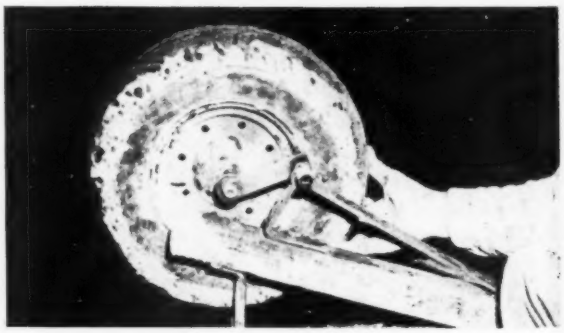
Underground Insulation for Steam Pipes Is Cast After Lines are Assembled, Anchored and Tested

A method for insulating underground steam lines with vermiculite mineral insulation has been developed by The Zonolite Co., miners and processors of vermiculite. Called the Z-Crete system, it utilizes insulating concrete composed of Portland cement, vermiculite aggregate, special waterproofing admix and water, entirely wrapped in waterproof envelope consisting of three moppings of hot pitch and two layers of tar saturated felts.

This insulated case is applied after all pipes are assembled and anchored into a continuous structural base and tested. It forms a strong monolithic embedment around the pipes and, according to reports, it produces a permanent rot-proof insulation that will not disintegrate from wetting or exposure to the elements. No metal rollers or supports are used because the pipes are continuously supported and aligned in the insulating concrete and on Z-Crete support blocks at suitable spacings.

The Lowly Wheelbarrow gets Swinging Suspension for its Wheel

With a smooth wave-like gliding movement, lever action of the swinging suspension on this wheelbarrow converts forward momentum into a lifting action that eases the load up on top of an obstacle, says the inventor William Gemienhardt, member of the New York University College of Engineering staff.



The suspension provides for the wheel to swing longitudinally and the wheelbarrow rides over curbs with relative ease.

During the past four years, the new wheelbarrow has been tested on a number of construction jobs including the current project on the new gymnasium at New York Uni-

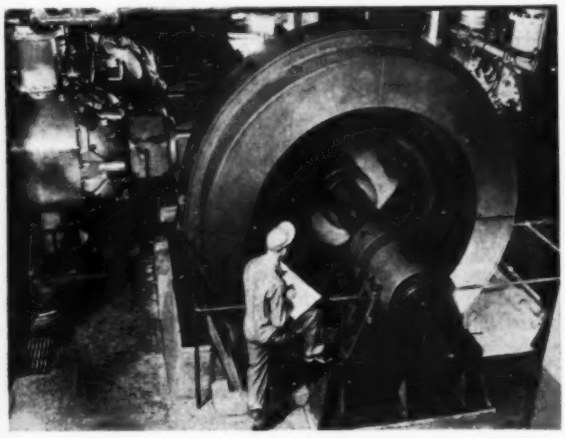
versity. When the new vehicle is used, elaborate plank tracks are unnecessary, road shocks are absorbed, fatigue of operators is reduced and greater loads can be carried without danger of spilling. Detouring around small holes and ruts is unnecessary, dumping is relatively effortless, and wedges at normal curbs are not needed.

The swinging suspension transmits a smooth wave-like gliding movement to the vehicle instead of abrupt, jerky shocks. Lever action of the suspending arms converts forward momentum into a lifting action that eases the weight of the barrow up onto the top of an obstacle thus eliminating the need for raising effort by the operator.

The inventor is now working on designs which will apply the same swinging suspension to cross country vehicles.

4500 hp Synchronous Motor Drives Reciprocating Gas Compressor Delivering 36,000 cfm

The largest synchronous motor in horsepower rating ever to be applied to drive a reciprocating compressor was installed recently in the Portland (Oregon) Gas and Coke Co. plant. Driving a Clark six-cylinder compressor, the giant motor built by General Electric, is rated at 4500 hp, 300



rpm, 11,000 volts. According to engineers, the compressor will handle up to 2,160,000 cubic feet per hour of manufactured gas at 40 psi for more than 100,000 consumers in an 80-mile radius.

For peak winter loads, full output will be required. For off-peak loads, however, cylinders or half cylinders may be bypassed, giving a variable through-put from a constant-speed drive.

Glass With Electricity-Conducting Skin Makes Good Industrial Heating Element

Glass, with a transparent metallic coating that conducts electricity but resists enough to heat the glass up to 660° F, has been developed for heating elements suitable for baking or drying applications where a uniform temperature over an area is desired. The metallic skin is about 16 millionths of an inch thick.

Called E-C (electrical conducting) coatings by the Corning glass Works, it is applied to Pyrex brand borosilicate glass made up as radiant panels.

The conducting film is applied to one surface of the glass in a uniform or non-uniform thickness as the application requires. Electrical contact is made through silver bands permanently bonded to opposite edges. Made with varying degrees of resistivity from 6 ohms to several thousand ohms per square, E-C can be operated with alternating current

CUTS COSTS

because it is easy to operate and maintain!

O & S Powermaster gives you cost-saving features like these . . .

1. **FUEL SAVINGS UP TO 30%.** Designed to operate efficiently with inexpensive heavy oils as well as light oils or gas. (Change oil to gas or gas to oil *in 10 minutes*!)
2. **LOW-COST MAINTENANCE.** Swinging rear and removable front covers make cleaning easy — without dismantling burner or controls. Also saves inspection time.
3. **AUTOMATIC OPERATION.** Ignited electrically with gas or light oil. Produces full steam pressure quickly. Operates only as steam is needed.
4. **PACKAGED DESIGN** saves installation costs. Delivered fully wired, factory-tested and mounted on steel base. No bricking required.

High and low-pressure units—15 to 300 H.P.—for light oil, heavy oil, gas or combination gas-oil firing. Free catalog mailed promptly—use coupon below.

ORR & SEMBOWER, INC.
Established 1885

Powermaster® STEAM GENERATORS

ORR & SEMBOWER, INC.
950 Morgantown Rd., Reading, Pa.

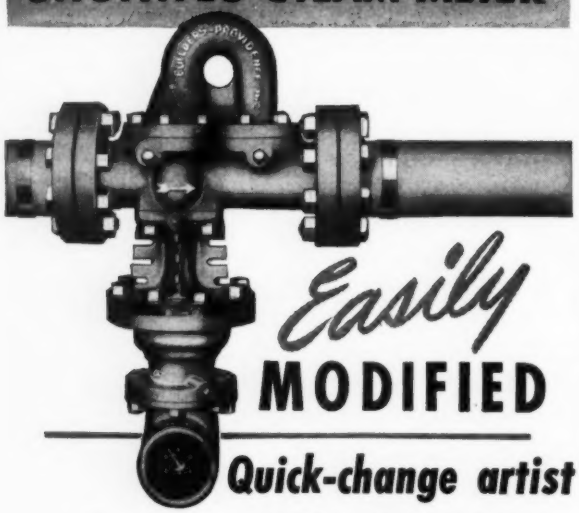
Please mail latest catalog showing Powermaster's cost-cutting advantages.

Name_____

Company_____

Address_____

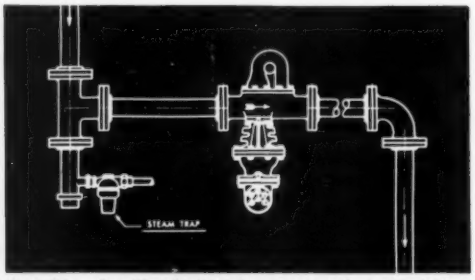
ANOTHER IMPORTANT FEATURE OF SHUNTFLO STEAM METER



Easily MODIFIED

Quick-change artist

Builders Shuntflo Steam Meter is easily modified for change in capacity. Simply remove the top cover, install a new orifice plate, and replace the cover . . . that's how easy it is to change from one capacity range to another. Many companies buy Shuntflo Meters with a complete set of orifice plates for checking steam, air, or gas consumption by individual machines, processes, departments, etc. Meters soon pay for themselves—they show accurately (within ± 2%) *where* the commodity is being consumed and *how much* . . . directly in pounds of steam, or cubic feet of air or gas. For engineering information and Bulletins 400-F1 and 400-F2, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.



Method of installing Shuntflo Meter in horizontal offset of vertical main

Builders makes a complete line of flow meters and controllers for liquids, steam, air, gas, and dry materials . . . mechanical and differential . . . including The Venturi Meter and Chlorinizers (chlorine gas feeders).

BUILDERS PROVIDENCE *Instruments*

at 115 or 230 v as a heating device with maximum temperatures up to 660° F. Corning offers the panels in two sizes, primarily for industrial use. Currently they are being used for such service as textile drying, lacquer drying and paper coating.

Winder Produces Large Insulating Tubes for Transformers

Tube-winding equipment placed in operation by Synthane Corporation of Oaks, Pa., laminator and fabricator of thermosetting plastics, now permits production of tubes up to 26 in. OD, 25¾ in. ID. Winder accommodates a maximum tube length of 96 in. With previous equipment, maximum OD available was 23 in.

Installation of the equipment reflects the demand for these big tubes by transformer manufacturers who require the insulation properties of laminated plastics, and by the textile industry, which specifies these tubes to close dimensional tolerances, for non-snagging surfaces and resistance to moisture and chemicals.

ASA Ups Specifications for Rubber Protective Equipment Used by Electrical Workers

Four new specifications for rubber protective equipment used by electrical linemen have been approved as American Standards. These cover: insulator hoods, blankets, sleeves, and line hose.

These standards were developed by a committee of 15 national organizations sponsored by the American Society for Testing Materials and the Edison Electric Institute under the procedures of the American Standards Association.

The fact that rubber and compounding materials of prewar high quality are again available brought about the preparation of this new standard which replaces a 1945 edition.

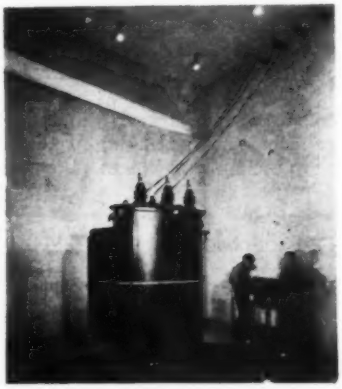
One of the principal changes is an increase in tensile strength. For both insulating hoods and line hose the minimum limit for tensile strength has been increased from 1200

SHOWS THE LATEST IN DRY CHEMICAL FIRE EXTINGUISHERS
At recent Safety Show in New York, E. A. Fullarton (left) of Travelers Insurance Co. looks over new type Ansul dry chemical fire extinguisher. David Francis (center) and Ralph Moore, Ansul representatives, explain its features

psi to 1600 psi; for insulating blankets from 1400 psi to 2500 psi, while for the insulating sleeves the increase is from 1800 psi to 2500 psi.

The wartime specifications contained the safe working voltage (volt rating) as part of the title of each standard. However, as the safe working voltage varies under different climatic conditions it was decided to replace the "volt rating" with the phrase "Proof test 10,000 volts, 3 minutes," for example, to indicate that this is the test voltage under laboratory conditions.

Excludes Exterior Noises When Analyzing Transformer Harmonics



A two-room engineering laboratory designed primarily for audio noise and special temperature tests has been placed in use at Allis-Chalmers Manufacturing Co. plant in Pittsburgh. Auxiliary test equipment delivers 1,200 kva over a wide range of voltages, which permits standard testing of transformers up to 5,000 kva.

Two-foot thick walls are constructed of concrete, concrete block and air pockets, fiber glass and acoustic tile. Its ambient noise level is 27 decibels with the walls absorbing 99.98 percent of the exterior noise power. In this laboratory, the transformers are mounted to simulate actual installation conditions, thereby making it possible to determine the noise level under ideal conditions.

A draft-free ventilating system provides uniform and constant ambient temperature. Capable of absorbing 100,000 Btu per hour, the system maintains constant ambient temperature throughout the duration of temperature tests.

Builders - %Proportioneers% - Omega Celebrates 130th Anniversary By Moving Into New Plant

As part of its 130th Anniversary celebration, Builders Iron Foundry and its affiliated industries, Builders-Providence, %Proportioneers%, and Omega Machine Co. held a dedication and open house on March 31, at their new quarters at 345 Harris Ave., Providence, R. I.

After 130 years on Codding St. this move to Harris Ave. constitutes another milestone in the history of the company; a history which includes service to our country in four wars; the development of the venturi meter and its recording devices; filter effluent controllers; the Chronoflo telemetering system; and many other measuring and recording instruments. Other milestones include the association in 1933 with %Proportioneers% for the development of liquid chemical feeders and in 1944 with Omega Machine Co. for dry chemical feeders.

Long a dream of the management, this move places the administration, engineering, sales, and service departments adjacent to the manufacturing departments and increases the efficiency of operation and service to the customer. The new office building contains 26,000 sq ft of floor space, is completely air conditioned, sound proofed and fluorescent lighted. In addition, the companies acquired a large building into which was moved the growing sheet metal depart-

The OLD MAID treatment For FLEXIBLE METAL HOSE

● Recently, an Atlantic engineer scanned specifications on an order for flexible metal hose . . . A question as to dimensions! . . . A call to the client . . . A typing error corrected—a very costly mistake avoided . . . Final comment by the client, "You're as finicky as an Old Maid in attention to detail. Thanks!"

● Just routine but your assurance of satisfactory solution of every hose problem. That's why every length of Atlantic metal hose is ***job tested and guaranteed to do its job.*** ATLANTIC METAL HOSE is ***better*** for isolating vibration, connecting misaligned stationary and moving parts, mobile service, eliminating rigid bent pipe and fittings . . . for conveying live steam, compressed air, chemicals, light and semi-solids.

Bronze, steel or stainless steel. Size 1/8"-36" I.D. inclusive. Standard or special couplings, flanges, nipples and fittings.

WRITE FOR BULLETINS . . . .

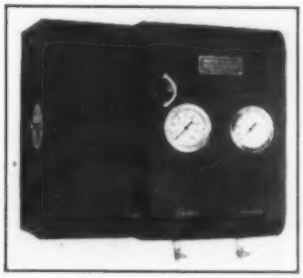
ATLANTIC METAL HOSE CO., Inc.
124 West 64th Street, New York 23, N. Y.

TIRED ***of operating your zeolite water softeners by hand???***

Wasting Time?
Salt? Water?

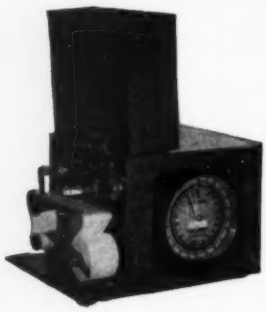
Then ***change*** to fully or semi-automatic (push button) operation using **H & T** Poppet Type Multiport Valves.

Send for Bulletin V-1 or A representative will call.



HUNGERFORD & TERRY, INC.
Clayton, New Jersey
Over 50 years experience—Over 5,000 installations

A RECORDING MECHANICAL COUNTER



Actuated by an Electrical Impulse

it operates on the output of a scaler, photo tube, or other electrical unit . . . permanently records counts on a 2¼" tape . . . automatically resets to zero.

In Radioactive Research it saves precious time by eliminating many hours of manual labor, resulting in greater economy and efficiency.

In industry it maintains a permanent record automatically, recording production and time each hour.

Write for complete information and illustrated circular S C 18

STREETER-AMET COMPANY

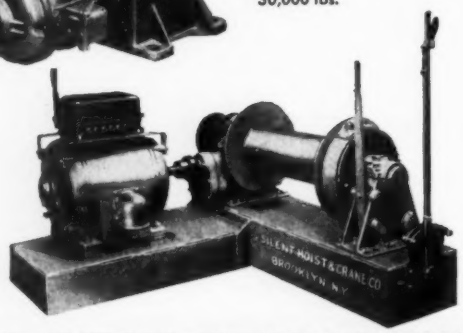
AUTOMATIC WEIGHT RECORDERS & SCALES
HIGH SPEED COUNTERS SINCE 1888
4101 Ravenswood Ave., Chicago 13, Illinois

CAR PULLERS, BARGE MOVERS

ELECTRIC, GASOLINE, DIESEL

Let *Silent Hoist* Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.

CAPSTAN 6 Sizes: Draw Bar Pull Capacities	DRUM WINCH 4 Sizes: Pull Capacities
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of KRANE KAR Swing-Boom Mobile Cranes, LIFT-O-KRANE Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.

SILENT HOIST & CRANE CO.

856 63rd STREET, BROOKLYN 20, N. Y.

ment. Adjacent smaller buildings house the equipment demonstration and training room and the development laboratories. The foundry remains at its original location on Codding Street.

Idaho Gets New Multi-Million Dollar Pulp and Paper Mill

Potlach Forests, Inc., in building its new multi-million dollar mill at Lewiston, Idaho, is completing another step in its extensive plans for greater utilization of the "mixed woods" that grow abundantly in northern Idaho and more complete integration of diversified products manufactured at one plant site. The rated capacity at the start of operation, scheduled for January 1, 1951, will be 150 tons per day.

Major item on the list of electric apparatus is a General Electric 10,000-kw 12,500-kva steam turbine-generator set. Several mechanical drive turbines also will be furnished, one for the paper machine itself, and others for power house auxiliaries.

About 300 electric motors and gear motors ranging in size from 1 to 800 hp are included. Total rating of all the G-E motors to be installed in the mill amounts to more than

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Air Conditioning Cab Of Shovel Handling Steel Mill Slag", December, 1949.
"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . . " October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention", H. R. Smith, September, 1949.
"How To Select Correct Steam Trap", Thomas Trail, January, 1950.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"A Lamson Installation", Calvin A. Burton, August, 1949.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", R. A. Cattell, November, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughn, November, 1949.
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. Sludge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Mottershead, November, 1949.
"Supervisor's Personal Check-Up Chart", November, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

10,000 hp. G-E will supply motor control center equipments with circuit breaker combination full-voltage magnet starters. A 12,000-volt metal-clad switchgear unit will be used, as well as two indoor master unit substations, and six load center unit substations.

Improved Refractories Sought Through Training Program for Executive, Sales, Production Forces

The Robinson Clay Product Co., Akron, Ohio, has inaugurated a practical training program to meet new challenges presented by post-war competition in the manufacture and distribution of refractories products. This program, unique among clay producers, recently got underway with a three-day refractories conference in Akron.

Company executives brought together production, sales and research teams to discuss jointly the products they are responsible for producing and selling and to work out better methods of serving the power, processing, steel, foundry, glass and ceramic industries.

Robinson is one of the largest manufacturers in the clay products industry. The firm has factories, quarries and mines in Ohio, Pennsylvania and Missouri. Sales representatives cover 19 states, as well as industrial areas in Canada. The conference agenda included talks by all department heads, as well as question and answer forums at all sessions.

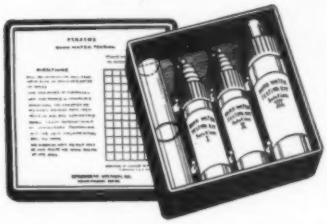
Polyethylene-Covered Aluminum Wire Offers New Advantages

Polyethylene-covered aluminum line wire, an electrical conductor possessing marked advantages where weatherproof or covered wire is desired, is being used by Kaiser Aluminum. First to adopt this covering for aluminum conductor, this firm has also used copper wire with polyethylene covering. PE covering is offered in a full size range of solid and stranded aluminum conductor as well as small

AUSPICIOUS START FOR GENERAL CONTROLS $100,000 BUILDING

Last month at Glendale, Calif., concrete started pouring into the foundation of a new building that will raise the under-roof area at General Control's plant to 200,000 sq ft. The new facilities will be devoted to assembly operations, on the company's automatic pressure, temperature, level and flow controls. Construction ceremonies got underway with Starlet May Donovan handling the first shovel full of concrete, and the following members of GC's board of directors watching her technique: L to R — Jackson Long; I. H. Nye; E. F. Kitchel; S. H. Nye; J. F. Ray, vice-president and director of sales; A. W. Ray, vice-president and general manager; Wm. A. Ray, president and chief engineer; Wm. T. Doyle; and W. R. Ray, chairman of the board

New *VERSENE test kit determines total water hardness in less than *TWO MINUTES***



Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

Order The New Versene* Water Hardness Testing Kit today. $3.00 Postpaid. Send Checks or M.O. No. C.O.D.'s. Money Back Guarantee

We also maufacture and supply di sodium versenate (the di sodium salt of ethylene diamine tetra-acetic acid). This is the reagent used in the Schwarzenbach Method for the determination of water hardness. It is an analytical reagent grade chemical.

50 g. $2.00 100 g. $3.00 500 g. $10.00 Postpaid.

BERSWORTH CHEMICAL COMPANY
FRAMINGHAM, MASSACHUSETTS

*Trade Mark

PATCH FLOORS

WITHOUT HALTING TRAFFIC

No longer is it necessary to close off an area of concrete floor while waiting for newly installed patches to set. Flexrock offers a new plastic repair material which is ready for traffic almost the moment it's put down.

Tamp Smooth! Truck Over Immediately!

There is no waiting. Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is restored to solid smoothness . . . back in service without delay. Tough INSTANT-USE bonds tight to old concrete, makes long-lasting heavy duty patch or complete overlay. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

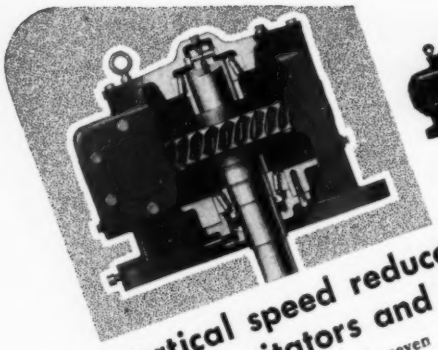
MAIL COUPON for FREE TRIAL OFFER and HAND BOOK OF BUILDING MAINTENANCE

INSTANT-USE

FLEXROCK COMPANY
3605 Filbert St., Philadelphia 4, Pa.
Offices in Principal cities

Please send me complete INSTANT-USE information, details of TRIAL ORDER PLAN and HAND BOOK OF BUILDING MAINTENANCE—no obligation.

Name .....
Company .....
Address .....



Type ND, with drive shaft down

A new vertical speed reducer to drive agitators and mixers

IMPROVED worm gear drive—in seven sizes each of two types—ready for prompt delivery. Designed especially for agitators and mixers, and for use with supplementary low-speed spur gear drives, without requiring outboard bearings. WRITE FOR BULLETIN 125, describing types NU and ND, with capacity charts and dimension data. The Cleveland Worm & Gear Co., 3253 East 80th St., Cleveland 4, Ohio.

For personalized service: Write or phone John E. Milliken Cleveland exch. VUlcan 3-4560

CLEVELAND Worm Gear *Speed Reducers*

It Sticks-It Insulates-It is Easier to Apply

R & I Stic-tite Insulating Cement is three times as adhesive as ordinary insulating cement and it covers twice the area. Consequently it is easier to apply.

Moreover, it has three times the insulating value, and will save about 90% of the heat lost from uninsulated boilers, hot-water tanks, valves and fittings.

It comes in 25-lb. and 50-lb. bags.

Your supply house has it. Write us for Bulletin I-75.

REFRACTORY & INSULATION CORP.

118 Wall St. New York 5, N. Y.

Chicago 4, Ill., Newark 2, N. J., Philadelphia 2, Pa.

R&I **Stic-tite** Insulating Cement

sizes of the ACSR (aluminum cable steel reinforced).

This type of covered wire offers advantages over the conventional textile coverings in that it is a smooth, clean, non-sticky plastic material, black in color, with superior resistance to moisture, sunlight, weather hazards and abrasion. Although polyethylene itself is more costly than other covering materials, its use in combination with aluminum conductor gives a product with high serviceability and attractive economy.

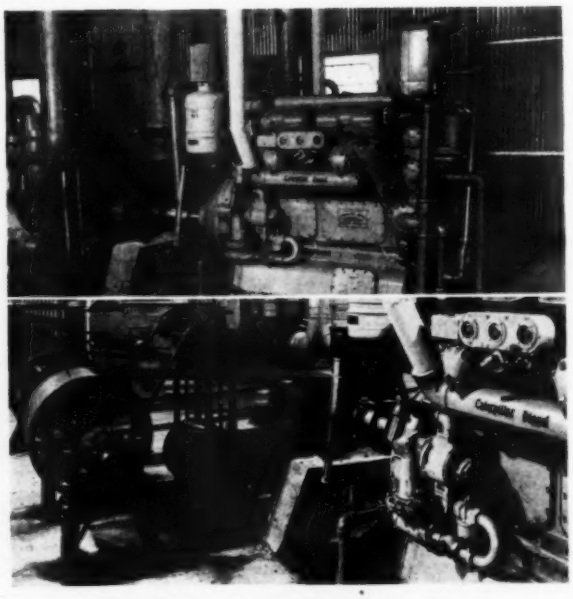
Weatherproof or covered wire is most widely used for overhead lines in urban areas, and is required by municipal and other regulations.

Pressure-Relieving Capacities of Diaphragms and Other Types of Explosion Vents

Designers of industrial buildings and equipment will find in a Bureau of Mines Report released last month, considerable help toward preventing heavy damage from dust explosions. It covers a series of tests to determine the effectiveness of various devices for venting explosion pressures to the open air.

Although free openings provide the most effective vent, their use is impracticable in many operations. For this reason the recent tests were made with diaphragms, hinged panels, and several types of glass, both scored and unscored.

The report describes the various types of vent closures tested, some of which proved effective in preventing or at least minimizing the effects of dust explosions, and includes a table in which these closures are listed approximately in decreasing order of their effectiveness in venting explosions. It is obtainable from the Bureau of Mines, Publications Distribution Section, Pittsburgh 13, Pa. Ask for Report of



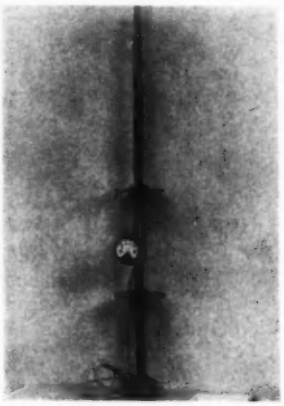
DIESEL RATED 375 HP DRIVES ENTIRE GIN MILL

This Caterpillar D375 diesel supplies power for all the handling operations at the Silver City, Miss. plant of the Farmers Gin Co., which turns out 120 bales of cotton every 24 hours. It runs five fans, four gin stands, four extractor feeders, a two-story press, and a burr machine, cylinder cleaner, a separator, and a dryer. One gin stand and some cleaning equipment was added last year, overloading the old diesel producing 120 hp at 257 rpm. The D375 Caterpillar was installed with V-belt drive as shown here

Investigations 4636, "Pressure-Relieving Capacities of Diaphragms and Other Devices for Venting Dust Explosions."

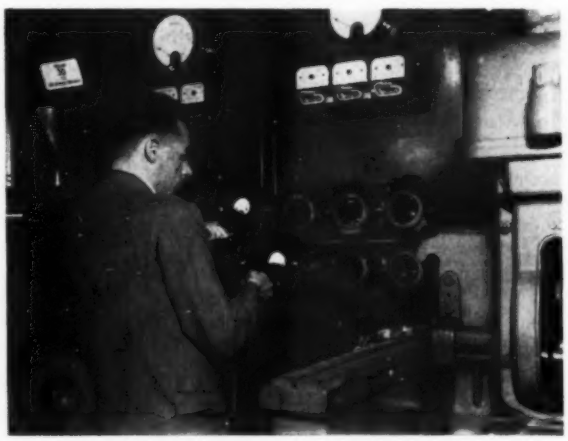
Electrostatic Voltmeter Spots Live Conductors And Phases Out High-Voltage Lines

Here is a portable instrument that measures voltage to ground up to 20 kv on live lines. Grounded end of test stick is held in the hand, and the other end applied to the line to be tested. The voltmeter is connected through a capacitance potential divider to the line probe. Instrument accuracy, plus or minus 5%, makes it possible to identify a live conductor from one having a voltage induced on it by its nearness to live conductors. Model 1 is good for 11 kv and Model 2 for 33-kv systems.



Phasing out live high-voltage lines can be done simply and safely with portable equipment consisting of two of these electrostatic high-voltage indicators with an intermediate electrostatic voltmeter mount on one stick and a connecting lead running to the other stick. Each stick is provided with a heavy ground lead.

The testing probes are then applied to the two lines to be compared. The reading on the intermediate electrostatic voltmeter will show a difference in potential or phase between the two lines. If the two lines are at the same potential and in phase the voltmeter reads zero. The reading may be checked immediately by earthing one of the test probes. Two models are available in suitable carrying cases from Ferranti Electric, Inc.



Lincoln Electric Gets Building Erected With "Breathing" Steel

Illustrated below are three stages in the erection of the "breathing" steel, Fiberglas and aluminum sidewall, being used by The Austin Company to enclose the new 850,000 square foot plant which it designed for The Lincoln Electric Company. The men on the left are installing Fiberglas insulating board, which is fastened to the inner steel (Ferrobord) wall by means of 10-gauge headless welding pins

Is this the solution to your lubrication problems, too?

FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

Write for these FREE bulletins

For personalized service: Write or phone, John E. Millikan, Cleveland exchange—VUlcan 3-4560.

FARVAL
CENTRALIZED SYSTEMS OF LUBRICATION

The action of Sand-Banum is colloidal. Water is variable, even differing from hour to hour in the same locality. Sand-Banum "treats" boilers and tubes which are constant factors.

Sand-Banum envelops each and every grain of incrusting solids, regardless of chemical composition. New scale cannot form in the presence of Sand-Banum, and old scale is gradually dissolved.

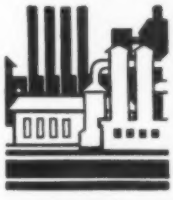
Sand-Banum is guaranteed absolutely harmless to all personnel and equipment.

Write For Details

SAND - BANUM
Pure Colloidal Concentrate

SOLVES YOUR Boiler Scale Problem!

Use Ounces Only Once A Week



AMERICAN SAND-BANUM CO.
Established 1926
9 Rockefeller Plaza
New York 20, N.Y.
SAND BANUM

KEEP YOUR EYES
ON
HALLOWELL
SPS

SHOP EQUIPMENT
OF STEEL

Latest developments in plant, design, and techniques at SPS are producing an improved line of Shop Equipment. The product shown is only one of the many HALLOWELL items now being manufactured.

The popular new HALLOWELL "CARRY-TOOL" of Steel.

Work Benches
Foreman's Desks
Tool Stands
Platform Trucks

Posture Stools
Posture Chairs
Cabinets
Folding Tables

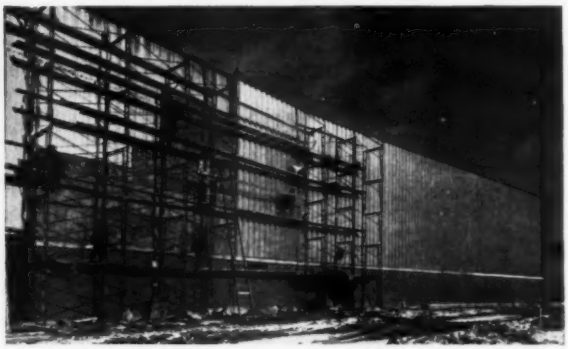
Write for Descriptive Literature

SPS STANDARD PRESSED STEEL CO.
JENKINTOWN 39, PENNSYLVANIA

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

installed with the Nelson stud welding gun and on which the insulation is secured with a speed clip.

A section of the exterior wall, complete except for black aluminum coping, can be seen on the right, after removal



of the scaffolding. It is faced with deep box aluminum panels which are secured to the inner wall by Nelson studs and special aluminum transition washers and aluminum acorn nuts. These were developed by Alcoa and Truscon engineers to eliminate the possibility of galvanic action between the aluminum and steel wall components.

"Much Ado About Nothing"

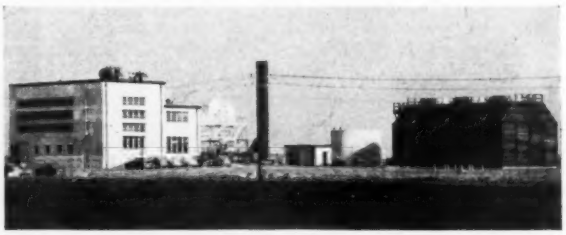
The Beach-Russ Company has just issued the first number of a new house organ, "Much Ado About Nothing," published in the interest of better vacuum processing through the use of better vacuum pumps.

Anyone wishing to have his name placed on the mailing list for this publication should address the Beach-Russ Company at 50 Church St., New York 7, N. Y., or through this publication.

Standards Approved In Many Fields

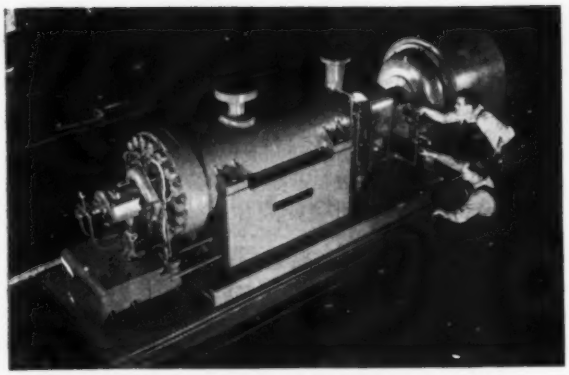
Rapidly growing importance of American Standards Association as a factor in American industrial economy, in the quality and cost of industrial and consumer goods, and in public safety is reflected in multiplying American Standards.

A report and chart just issued by ASA show that the number of new and revised American Standards approved during 1949 was almost double the average number approved annually during speeded-up activity of five war years. More than five times as many standards were approved in 1949



LATEST TEXAS POWER STATION GOES ON THE LINE

Now producing power for Bryan and College Station, Texas, and supplementing the Brazos Valley power house, is the illustrated $1¼ million Bryan Municipal power plant. The 5000 kw steam generating plant was constructed by Thomas Bryan and Associates, Inc. This firm also supervised the installation of boilers, generators and other equipment



BARREL-TYPE FEED PUMP OPERATES AT 2500 PSI

This single-suction double-case boiler feedpump has been designed for higher than normal efficiencies and operation in the 1200 to 2500 psi range. Development was based on exhaustive tests of various types of volutes, return passages and impeller types and arrangements. It will supplement Allis-Chalmers Doubleton pumps which have been built for 1900 psi at a capacity of 1400 gpm with seven stages

as the annual average for the first 13 years of the association's operation.

Standards were approved or revised during 1949 at the rate of one every working day. The 268 approvals last year bring the total number of American Standards to 1121 and total revisions to 1014. The latter number indicates the importance attached to keeping standards up to date, as necessitated by new developments in materials and methods, new experience, and improvements or changes in conditions.

Water Lubricates Graphite Brushes At High Altitudes

Graphite brushes for motors or generators on high-altitude air-craft, may have their useful life increased many thousands of times as the result of new lubrication methods devised by Robert H. Savage, in the General Electric Research Laboratory here.

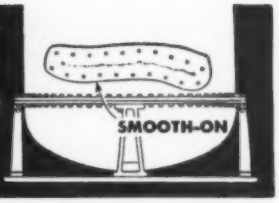
His discovery about water, in the form of vapor, for the lubrication of graphite has changed accepted ideas that this solid and "slippery" material was a good lubricant in itself. Graphite consists of layers of atoms which can slide easily over each other, and it was formerly supposed that this property was inherent in the graphite alone.

He has shown, however, that an invisibly thin film of moisture on graphite is required for its lubrication. Testing the wear against a revolving copper disk in a vacuum chamber, he found that dry graphite brushes were worn as fast as an inch within one hour. When a small amount of water vapor was admitted to the chamber, the wear rate was reduced to less than a thousandth as much.

For electric motors and generators working on the ground, the wear of brushes is no great problem, since there is generally enough water vapor in the air to provide the lubricating film of moisture. But modern aircraft, such as jet aircraft, fly at great altitudes in rarefied air at such a low temperature that water vapor is almost completely absent.

Mr. Savage has devised a means of shielding the parts of electric equipment where the brushes are used, and supplying water vapor to the space around them. In tests with this equipment he has found that brushes which wear out in an hour without water vapor, will last from 2000 to 8000 hours.

To Repair A CRACKED CASTING



Smooth-On No. 1 Iron Cement, under a bolted patch plate, saved this large casting without the use of heat, when a long crack threatened to end its usefulness. This simple repair is typical of the countless uses that engineers, mechanics and maintenance men in industrial plants find for Smooth-On. They keep it handy for both emergency and routine maintenance repairs—stopping leaks, sealing cracks, tightening loose parts. If your supply house hasn't Smooth-On No. 1 in 1-, 5-, 20-lb. or larger size, write us.

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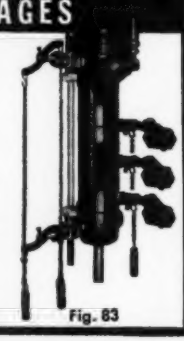


Fig. 83

Certain organic vapors are more effective than water by a factor as large as 1000, so that extremely small concentrations (in the order of parts per million) provide lubrication.

Further developments are now being carried on, to apply the findings to actual aircraft where the wide range of operating conditions impose some problems that have yet to be solved. The practical merits of equipment with shielded parts are undergoing evaluation in comparison with equipment using chemically treated brushes.

Fire Alarm System For Generators Operates On Abnormal Temperature Rise

First application of its Vigilarm fire detection system to rotating machinery was reported by the Gamewell Co. In the successful adaptation by a west coast public utility, it is said to help effect control in five to ten seconds of flash-over fires in giant power-house generators.

Rodolph S. Oliver, head of Gamewell's Vigilarm division, declared the system operates when there is abnormal temperature rise. It automatically relases water-fog or carbon dioxide extinguishing agents where temperature exceeds a pre-determined safety point in the generators. Expanded air in the tubing operates extingushing devices in a fraction of time required by fixed temperature thermostats.

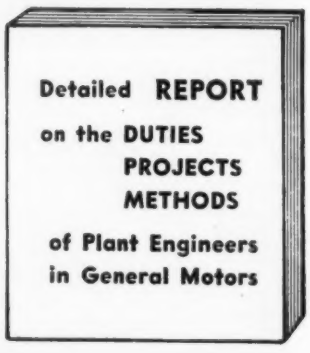
Extensive tests by the public utility on specially-built "mock-up" generators indicated there now would be little harm to electrical windings, in event of flash-over fires.

Fuel-Burning Equipment Restrictions Of Anti-Smoke Ordinances Compared

Restrictions on the sizing of fuel-burning equipment imposed by smoke-abatement ordinances of 20 cities and counties, including Toronto, Canada, are summarized in a publication released today by the Bureau of Mines, U. S. Department of the Interior. The circular was issued as part of the Bureau's long-established program for aiding municipalities and private concerns in achieving smokeless combustion.

The publication points out that "even after many years of fuel-burning practice and experience there is no common standard." Varying requirements for the same type of equipment under the same conditions not only affect installation costs, but also have a bearing on the competitive position of different types of fuel-burning equipment.

Full-page drawings of nine types of boilers are contained in the 19-page circular. It also includes a series of tables giving minimum furnace-setting heights required by various cities and counties for different types of fuel burning equipment, a comparison for various localities showing the



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approximate percentage difference in furnace-setting heights required from those recommnded by the Stoker Manufacturers' Association, arbitrarily chosen to serve as a basis of comparison, minimum recommended chimney sizes for heating boilers when the stoker is operated at manufacturers' rated capacity, and other similar information not hitherto available in a single publication.

A free copy of Information Circular 7557, "Fuel-Burning Equipment Dimensions Required by Smoke-Abatement Ordinances," may be obtained by writing to the Publication Distribution Section of the Bureau of Mines, 4800 Forbe Street, Pittsburgh 13, Pa.

10,000 HP Of Motors For Steel Mill

Westinghouse Electric Corporation recently received an order from the Weirton Steel Company for $840,000 worth of electrical equipment for modernization of a 15-year-old strip mill. The modernized mill will be driven by new electric motors totalling 10,100-hp—an increase of 6000-hp; and the speed of the mill will be doubled—from 1500 to 3000 feet per minute.

K. M. Patterson, manager of the steel-mill section for the Westinghouse industrial sales department, said the equipment included new electric motors and controls for a 36-in. 4-stand tandem cold-reduction strip mill at the Steel Company's plant in Weirton, West Virginia. In addition to the four motors to power the mill stands and one for the reel—totalling 10,100-hp—Westinghouse also will supply a synchronous motor-generator set. With an 8,000-hp driving motor, this set will operate together with an existing motor-generator set to furnish power to drive the mill, motors and to control their speed.

Steel Mill Increases Capacity For Tin Plate And Slab

Carnegie-Illinois Steel Corp. have announced a program of improvements in the Chicago and Gary (Ind.) plants of this United States Steel subsidiary which will increase the tin plate producing capacity of the Gary Sheet and Tin mill by 120,000 tons annually. The new facilities to be built will increase this plant's annual tin plate capacity to 732,000 tons.

The two projects, which are interlocking, are scheduled to be completed and in operation by the end of 1950.

At the Gary Sheet and Tin mill a fourth electrolytic tinning line will be installed. This line will operate at 1,000 feet per minute.

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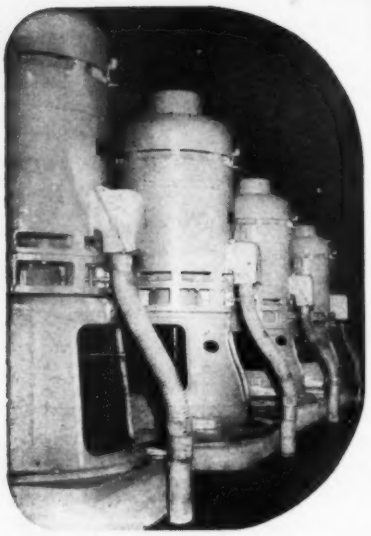

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We don't know exactly what kind of answers you will get, but according to past records, the "know how" boys — operating engineers, plant managers, water works superintendents and cost accountants will be mighty, mighty complimentary. They are the first to recognize and show genuine appreciation of good equipment. A list of your nearby Layne well water system owners will be sent on request. For other helpful materials—illustrated catalogs and folders, address

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Boilers and Furnace Construction units
Boiler Feed Water
Compressors
Cleaners & Blowers
Diesel Power
Dust and Fly Ash Collecting Equipment
Electrical Equipment
Floor Repairs
Fuel Firing Equipment
Heat Exchangers
Heating, Ventilating and Air Conditioning
Instruments
Insulation
Lubrication
Maintenance
Material Handling
Packings & Gaskets
Pipe and Fittings
Plant Equipment
Power Transmission
Pumps
Refractories
Regulators & Controls
Steam Turbines and Engines
Tools and Small Specialties
Traps, Strainers and Separators
Valves
Welding Equipment
Wire Rope
Miscellaneous

Slash Power Costs!!

WITH

TODD BURNERS

GAS OR OIL

You'll be amazed how Todd Burners cut your fuel and maintenance costs. Savings up to 10% . . . increased power capacity can be yours with Todd Burners. In replacement of obsolete equipment or in new installations, skilled specialists—backed by 35 years of Todd experience—engineer your job individually to assure you utmost economy in burning of liquid or gaseous fuels.

Oil Burners
Gas Burners
Combination Oil and Gas Burners

COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
81-16 45th Ave., Elmhurst, Queens, N. Y.
See the Classified Telephone Book

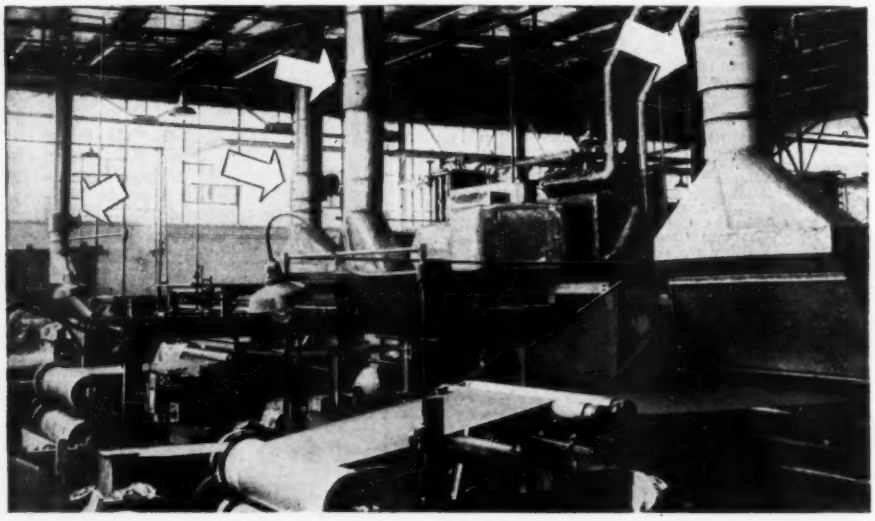
NEW YORK • BROOKLYN • ROCHESTER • BUFFALO • HOBOKEN • NEWARK • PHILADELPHIA HARRISBURG • YORK • PITTSBURGH • CHICAGO RALEIGH • CHARLESTON, S. C. • BOSTON SPRINGFIELD, MASS. • BALTIMORE • WASHINGTON • RICHMOND, VA. • ATLANTA • BIRMINGHAM • CLEVELAND • DETROIT • GRAND RAPIDS TAMPA • GALVESTON • SAN ANTONIO • DALLAS HOUSTON • TULSA • MOBILE • NEW ORLEANS SHREVEPORT • DENVER • SALT LAKE CITY LOS ANGELES • SAN FRANCISCO • SEATTLE MONTREAL • TORONTO • BARRANQUILLA BUENOS AIRES • LONDON

We'll whip your TOUGH Air-moving job

Have you an air-moving job which has never been *really* whipped? Or a new one which looks to be mighty tough? That's the kind we like! Frankly, such jobs are no fun for us . . . but when our equipment and our engineering help prove themselves up to the hilt, as they've done time after time, we've won a friend.

Want to move 50,000 CFM against 4" water gauge pressure? Sure we can do it . . . with a minimum of equipment and "cluttering-up", mighty low power consumption and long, trouble-free service.

Need better ventilation? Want to break up a hot-spot? Are there points of dust or fume concentration? Those are simple things to remedy, but to be *sure,* precisely the correct fan or blower, of the right size and type, should be specified. Don't just buy an oversize piece of equipment — buy the *right* size.



The photograph at the left shows Hartzell equipment installed at the Synthane Corporation, Oaks, Pennsylvania. Previous to the installation of Hartzell Belt-Drive Duct Fans, exhausting through the stacks shown, fumes and heat spread through the plant from the plastic coating machines in the photograph. The plant operator reports that both heat and fumes were completely eliminated by the installation, planned and specified by Hartzell.

When you write to us, or clip and mail the coupon below, you put the whole weight of Hartzell engineering, longest experienced in the propeller-type fan industry, to work on *your* air-moving problems. Application directly to your needs is handled by an experienced, competent Hartzell field office near you. Thus you get not only excellent air-moving equipment but also the widest performance experience available anywhere, applied to your plant by Hartzell men. For the tough or the simple job, do it *best* with Hartzell. Clip and mail the coupon now. There's not the slightest obligation.

CLIP — and mail now

I have an air-moving job which I consider tough, and I want it done right. Get the details from me and let me have your recommendations. This puts me under no obligation whatever.

Name_____

Company_____

Street and No._____

City and State_____

HARTZELL
PROPELLER FAN CO.
DIV. OF CASTLE HILLS CORP.
PIQUA, DEPT. B OHIO

PROPELLER-TYPE FANS AND BLOWERS—ROOF VENTILATORS—UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES